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A taxonomic review of Philippine Obrimini stick insects: The genus *Tisamenus* Stål, 1875 (Insecta: Phasmatodea: Heteropterygidae: Obriminae)

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lectotypes;
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Abstract. – A taxonomic review and redescription of the Philippine genus *Tisamenus* Stål, 1875 (Obriminae: Obrimini) at the species level is presented. *Tisamenus* is endemic to the Philippine Islands and distributed throughout most of the archipelago with the exception of the Greater Mindanao PAIC, and the greatest species diversity found on the island of Luzon. Differential diagnoses as well as notes on intraspecific variability and geographic distributions, including a great number of new records, are provided for all twenty-four known species with twenty-two of them illustrated. Keys to species are presented to distinguish females and males. Seven new species are described: *T. charestae* Hennemann & Le Tirant **n**. **sp**. from Luzon and *T. napalaki* **n**. **sp**. from Luzon and Palaui are described from the female, male and egg, *T. trapezoides* **n**. **sp**. from Luzon from the female and male, and *T. heitzmanni* **n**. **sp**. from Cebu, *T. irenoliti* **n**. **sp**. from Marinduque, *T. makinis* **n**. **sp**. from Luzon and *T. malawak* **n**. **sp**. from Camiguin are described from the males only. Two species are found to by synonyms (**n**. **syn**.): *T. fratercula* (Rehn & Rehn, 1939) is synonymised with *T. cervicornis* Bolívar, 1890 and *T. atropos* (Rehn & Rehn, 1939) is synonymised with *T. clotho* (Rehn & Rehn, 1939). The type-species *T. serratorius* Stål, 1875 is for the first time recorded from a precise locality on the island of Luzon and is re-described and illustrated along with descriptions of the previously unknown male and egg. The previously unknown males of *T. armadillo* Redtenbacher, 1906, *T. clotho* (Rehn & Rehn, 1939, *T. deplanatus* (Westwood, 1848), *T. draconinus* (Westwood, 1848) and *T. hebardi* (Rehn & Rehn, 1939) are described and/or illustrated for the first time, as are the previously unknown females of *T. hystrix* (Rehn & Rehn, 1939), *T. lachesis* (Rehn & Rehn, 1939), *T. polillo* (Rehn & Rehn, 1939) and *T. spadix* (Rehn & Rehn, 1939). Also, the eggs of *T. armadillo* Redtenbacher, 1906, *T. cervicornis* Bolívar, 1890, *T. clotho* (Rehn & Rehn, 1939), *T. deplanatus* (Westwood, 1848), *T. draconinus* (Westwood, 1848), *T. hebardi* (Rehn & Rehn, 1939), *T. lachesis* (Rehn & Rehn, 1939), *T. polillo* (Rehn & Rehn, 1939), *T. serratorius* Stål, 1875 and *T. spadix* (Rehn & Rehn, 1939) are described and illustrated for the first time. Only one species, *T. armadillo* Redtenbacher, 1906 remains without a precise locality with the historic type locality only given as "Philippines". Holotypes of newly described species are deposited in the collections of the Institute Royal des Sciences Naturelles de Belgique, Brussels, Belgium (RBINS), Zoological Museum, University of Kiel, Germany (ZMK) and the Montréal Insectarium, Québec, Canada (IMQC).

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Introduction

Considerable efforts have been made in the past twenty years to re-arrange the taxonomy and reveal the natural relationships within Old World stick and leaf insects (Phasmatodea). Attempts have included morphological approaches (e. g. Bradler, 2001; Hennemann & Conle, 2008; Hennemann *et al.*, 2009, Hennemann *et al.*, 2016), cladistic analyses of morphological data (e. g. Tilgner, 2002; Bradler, 2009) as well as molecular-based phylogenetic studies (e. g. Whiting *et al.*, 2003; Buckley *et al.*, 2010; Bradler *et al.*, 2015; Robertson *et al.*, 2018; Simon *et al.*, 2019; Bank *et al.*, 2021). Although the traditional classification originally introduced by Günther (1953) gained broad acceptance by subsequent authors (e. g. Bradley & Galil, 1977; Kevan, 1977; Kevan, 1982) the order was more recently considered to be lacking a phylogenetically based classification (Bradler & Buckley, 2018). Many of the results obtained by recent studies did not corroborate the traditional classification proposed by Günther (1953) and since then many inaccuracies have been uncovered and clarified, these being important steps towards a natural classification. However, presently several relationships within the Old World Phasmatodea remain questionable and although some clarity id forming there are still noteworthy discrepancies between the results of morphological and molecular data. One such case is the family Heteropterygidae, which since its official introduction as Heteropteryginae by Kirby (1896) has experienced various fairly inconsistent taxonomic arrangements (e. g. Redtenbacher, 1906; Rehn & Rehn, 1939; Günther, 1953; Beier, 1968; Klante, 1976; Bradley & Galil, 1977; Zompro, 2004; Hennemann *et al.,* 2016; Bank *et al.,* 2021).

The Heteropterygidae are a clade of Oriental stick insects that comprises broad-bodied and often strikingly spinose Phasmatodea that

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range in size from very small (e. g. genus *Planispectrum* Rehn & Rehn, 1939, subfamily Dataminae) but also contain the well-known large Jungle Nymph *Heteropteryx dilatata* (Parkinson, 1798), one of the heaviest insects worldwide with a body weight of over 50 g (Wood, 1976; Beccaloni, 2010; Hennemann *et al.,* 2016). Due to their remarkable looks, interesting habits, impressive defensive behaviours, and the fact that most species are fairly easy to culture, this clade has received particular attention over the past few decades. Moreover, the Heteropterygidae have recently been subject to three comprehensive and in-depth studies that aimed at clarification of the taxonomy and phylogeny of the clade, i. e. two morphological approaches (Hennemann *et al.*, 2016; Hennemann, 2023b) at the species-level and a molecular study (Bank *et al.*, 2021).

A comprehensive taxonomic review of the Philippine genera of Obriminae was presented by Hennemann (2023b). The present work studies the Philippine endemic *Tisamenus* Stål, 1875 (Obriminae: Obrimini), which is the only Philippine genus that was not covered in the study by Hennemann (2023b) because of its taxonomic complexity and richness in species. As was needed for the other Obriminae genera, this comprehensive taxonomic review of *Tisamenus* was rendered possible by recently received material by the author and specimens from the collection of the Institute Royal des Sciences Naturelles de Belgique, Brussels, Belgium (RBINS) from throughout the Philippines. This material includes several species new to science and due to the many fresh records of precise locality data, provides a precious contribution to our knowledge of the distributional patterns of the species of *Tisamenus*, some of which were previously only known from single type-specimens and unprecise localities like the 'Philippines'. The comprehensive study of Philippine Obriminae published by Rehn & Rehn (1939) included the most remarkable contribution to our knowledge of *Tisamenus* (referred to under the generic name *Hoploclonia* Stål, 1875), where they described as many as nine new species that are presently assigned to *Tisamenus*. Aside from its taxonomic contribution, the work by Rehn & Rehn (1939) introduced an 'acanthotaxy' to uniformly describe the major spines of the head and body of Obriminae, Due to the practicality, this 'acanthotaxy' has subsequently been applied for Obriminae taxa (e. g. Hennemann, 2023b) with modified versions also used for other subordinate taxa of the Heteropterygidae, namely Dataminae (Bragg 1998; Bragg 2001) and Heteropteryginae (Hennemann *et al.*, 2016).

Biogeography

The Philippines is an oceanic archipelago in the western Pacific Ocean composed of over 7.600 islands that are broadly categorized under the three main geographic divisions Luzon in the north, Visayas in the centre and Mindanao in the south (Fig. 1). The archipelago covers a total area of around 300.000 km^2 and is bounded by the South China Sea to the west, the Philippine Sea to the east, and the Celebes Sea to the south. The eleven largest islands are Luzon, Mindanao, Samar, Negros, Palawan, Panay, Mindoro, Leyte, Cebu, Bohol and Masbate, which together comprise about 95% of the archipelago's total land area (Chaffee, 1969: 6). Since the Philippines are situated on the western fringes of the Pacific Ring of Fire, the archipelago experiences frequent seismic and volcanic activity. The highest mountain is the volcano Mount Apo at 2.954 m on the island of Mindanao and in addition this this, there are 22 further active volcanoes among which are Mount Mayon, Mount Bulusan and Mount Taal on Luzon and Mount Canlaon on the island of Negros. The geographic and geological complexity and large area represent close to the optimum conditions for a high biodiversity and thus, the Philippines are one of the 17 world's megadiverse countries (Williams *et al*., 2001) and harbour among the highest rates of endemism in the world.

Despite its largely unique fauna (Heaney *et al.,* 2005), the Philippines have long been regarded as a distinct biogeographic entity (e. g. Cox, 2001) but more recent studies have revealed that the Philippines need to be regarded as part of Wallacea (e. g. Vallejo, 2011). Also, the phasmatodean fauna of the Philippines shows close relations to that of the rest of Wallacea, which is seen in numerous genera that are shared with either Sulawesi or the Maluku islands (Bresseel & Constant, 2017; Hennemann, 2021). On the other hand, many genera are shared with Borneo and Sundaland. However, any broader analysis of the Philippine phasmid fauna would still be premature and warrants a much better exploration and understanding of the Philippine Phasmatodea.

The Philippines have never been connected to any of the other Asian landmasses during their geological history. This isolation from the rest of Asia allowed this archipelago to develop a unique flora and fauna, thus explaining its high degrees of endemism. Moreover, many species are not only endemic to the Philippines but unique to individual Philippine islands. As many as 44% of its vertebrate species and almost 70% of its insect species are not found anywhere else in the world (Sinha & Heaney, 2006). Among the world's 25 top biological hotspots the Philippines ranks second in the number of species per km2, which means that the endemic species are concentrated in exceptionally small areas (Myers *et al.,* 2000). During glacial events, five major Pleistocene island-groups developed: Greater Luzon (composed of Luzon, Catanduanes, Marinduque and Polillo), Greater Mindanao (Mindanao, Bohol, Leyte, Samar and Basilan); Greater Negros-Panay (Cebu, Masbate, Negros and Panay), Greater Sulu (Tawi-Tawi and the Sulu Islands), and Greater Palawan. Principally, these Pleistocene island-groups reflect the currently recognized biogeographic regions of the Philippines. With the exception of Palawan, which became contiguous with Borneo when sea-level dropped repeatedly during the Pleistocene, none of the over 7.000 islands of the Philippines have ever been connected to any other Asian landmass. Even the islands of Mindoro, Sibuyan, Camiguin, and Siquijor have remained isolated from any of the larger islands (Heaney & Regalado 1998; Sinha & Heaney 2006), thus it is not surprising that each of these Pleistocene islands harbours endemic species. Even the small solitary island of Sibuyan, which has an area of less than 500 km^2, has its own impressive array of endemic species, although it is only a few kilometres away from Luzon. Other islands, such as Negros and Panay, share a considerable number of faunal species, which however are different from those of other adjacent Visayan islands such as Leyte and Samar. The fauna of Leyte and Samar, in turn show closer relationship to Mindanao and the fauna of Masbate is more related to that of Negros and Panay rather than the more nearby Luzon. These interesting patterns were observed in various terrestrial vertebrates including birds (Peterson *et al.*, 2000), amphibians (Evans *et al.,* 2003), mammals (e. g. Heaney & Regalado, 1998; Steppan *et al.*, 2003; Roberts, 2006; Esselstyn & Brown 2009) and reptiles (McGuire & Heang, 2001).

Material and Methods

All specimens examined for this study are dried and pinned. Insects and eggs were examined using magnifying glasses with 4x and 10x magnification and a Russian MBC-10 binocular microscope. Measurements of specimens and eggs were made to the nearest 0.1 mm using digital calipers. Photos of specimens were taken with a Nikon D7000 camera equipped with a Nikon DX AF-S Macro 40 mm lens and a wireless Nikon SU-800 dual speed light system. For details of insects a Raynox® DCE250 lens was used and background lightning was provided by a 18W 6000K LED panel light plate Photo editing was done with CorelDRAW® Graphic Suite 2021. The terminology and abbreviations used for naming and marking of morphological parts of the genitalia, head and thorax follows Beier (1968) and Bradler (2009). The terminology used for the spination and

Fig. **1**. Physical map of the Philippine Islands, showing all the main islands (Source: Wikipedia Commons. © Eugene Alvin Villar; https://upload.wikimedia.org/wikipedia/commons/6/6f/Ph_physical_map.png)

armature of the insects follows the acanthotaxy introduced for the subfamily Obriminae by Rehn & Rehn (1939) but is slightly adjusted for confining to the typical elements of armature that are important for the identification and distinction of species within *Tisamenus* Stål, 1875 (Fig. 47). The terminology used to describe external and internal egg structures is that of Sellick (1997, 1998). If not stated differently, the colours are described upon dried specimens only, and although the colourations are not of any significant importance for the distinction of taxa within *Tisamenus*, care must be taken because they may differ from the colours seen in live specimens. Specimen data are reproduced exactly as on the actual labels attached to the specimens, thus disregarding different languages. All of the labels in the author's collection (coll. FH) are in German language and therefore the German terms "Philippinen" (= Philippines), "Herkunft" (= origin) or "ex Zucht" (= ex culture) are not translated to English. Individual labels are separated by a semicolon.

Acanthotaxy

The arrangement, size and shape of the cephalic, thoracic and abdominal spines as well as the size, shape and sculpturing of the mesonotal triangular area are very important and useful characters for the identification and distinction of species within the genus *Tisamenus*. The mesonotal triangular area is peculiar to *Tisamenus* and a distinctive generic character that has proven to be uniform and typal within individual species, thus being of particular importance for the species distinction and identification. Although several species that are currently known from a larger number of individuals from different localities show considerable intraspecific variability concerning to certain elements of their armature and spination, essentially all species may easily be recognized by differences of their head and body armature. Names for the major spines in the subfamily Obriminae were first proposed by Rehn & Rehn (1939) and these are also used accordingly in this study. However, it appears eligible and helpful to confine these to the typical elements of armature that are peculiar to *Tisamenus*, which includes the characteristic mesonotal triangular area and its important features, and which are predominantly used in the distinguishing keys, differential diagnoses and descriptions presented herein. Therefore, an explanatory illustration is provided (Fig. 47).
It may be noted, that the total number of spines of the mesopleurae mentioned in the keys, diagnoses and descriptions below always includes the antero-lateral and mesopleural, thus comprises the antero-lateral, mesopleural laterals and the mesopleural (Fig. 47).

Abbreviations

ANSP: Academy of Natural Sciences, Philadelphia, Pennsylvania / U.S.A.
IMQC: Insectarium de Montréal, Montréal, Québec / Canada.
MNMS: Museo Nacional de Ciencias Naturales, Madrid / Spain.
NHMUK: Natural History Museum, London / U.K.
NHMW: Naturhistorisches Museum, Vienna /Austria.
NTUC: National Taiwan University, Taipei / Taiwan.
RBINS: Institute Royal des Sciences Naturelles de Belgique, Bruxelles / Belgium.
SMTD: Staatliches Museum für Naturkunde, Dresden / Germany.
UMO: University Museum, Hope Entomological Collections, Oxford / U.K.
UPLB: Museum of Natural History, University of the Philippines, Los Baños / Philippines.
USNM: United States National Museum of Natural History, Washington D.C. / U.S.A.
ZMK: Zoologisches Museum, Universität, Kiel / Germany.
FH: Personal collection of Frank Hennemann, Bad Homburg / Germany.
TB: Personal collection of Thies Büscher, Kiel / Germany.
HT: Holotype
AT: Allotype
PT: Paratype
ST: Syntype
LT: Lectotype
PLT: Paralectotype

Subfamily
Obriminae Brunner v. Wattenwyl, 1893

Type-genus. – *Obrimus* Stål, 1875b: 49.

Remarks. – A discussion of the subfamily Obriminae based on the latest phylogenetic data was provided by Hennemann (2023b) and shall not be repeated at this point. Solely, the treatment of the genus *Tisamenus* Stål, 1875 in the course of re-arrangements of the Obriminae shall be briefly summarized. Hennemann *et al.* (2016) proposed a subdivision of the Obriminae into the Miroceramiini (solely comprising the winged Wallacean genus *Miroceramia* Günther, 1934), the Tisamenini (containing *Tisamenus* and the synonymous *Ilocano* Rehn & Rehn, 1939, *Pterobrimus* Redtenbacher, 1906 and *Hoploclonia* Stål, 1875) and the Obrimini (containing all remaining genera of Obriminae). While these proposed relationships, that were solely based on morphological characters, were essentially reflected by the molecular approach by Bank *et al.* (2021), the resulting topology within Obriminae resulted as different and refuted these and all other previously established tribes with the exception of Obrimini. In contrast to preceding arrangements Bank *et al.* (2021) only recognized two tribes within Obriminae, the Hoplocloniini (only containing *Hoploclonia*) and the Obrimini (comprising all other genera of Obriminae). The validity of Tisamenini *sensu* Hennemann *et al.* (2016) was refuted by molecular data as being polyphyletic because *Hoploclonia* resulted as sister to all remaining Obriminae and *Pterobrimus* was recovered as sister to *Miroceramia*. Moreover, molecular data suggested *Theramenes* (see Hennemann, 2023a for more details on that genus) as sister to *Tisamenus* (and the synonymous *Ilocano*), but morphological aspects cannot yield support for such an assumption. Both genera are well recognized by unique morphological characters that (i) readily separate them from all other Obriminae and (ii) fundamentally distinguish both genera from another, and no synapomorphies have so far been found to support a sister group relationship between *Theramenes* and *Tisamenus*. Therefore, and despite the high UFBoot support value (99) for this topology, this result concerning the relationship between these two genera must still be regarded as doubtful and deserves further evaluation (Hennemann, 2023b: 5).
A comprehensive study of the Philippine Obriminae was published by Rehn & Rehn (1939), which described five new genera and a new subgenus as well as 24 new species and one new subspecies. The only other comprehensive treatment of the Philippine Obriminae was the taxonomic review presented by Hennemann (2023b), which described a new genus, eighteen new species, revealed nine new synonymies and also provided descriptions of various previously unknown sexes and eggs of described taxa. Further new taxa were described by Zompro (1996b), Hennemann & Conle, (2003, 2006), Lit & Eusebio (2005a, 2005b, 2006), Lit (2010a, 2010b), Lit *et al.* (2023), Acola *et al.* (2022) and Hennemann (2023a). Few papers have dealt with contributing to or completing the knowledge of previously described taxa (e. g. Lit & Eusebio, 2008; Seidenschwarz, 2018, Acola *et al*., 2022, Hennemann, 2023b) but there is a plethora of papers that reported on various aspects of Obriminae stick insects, described previously unknown sexes or eggs and provided notes on captive breeding (e. g. Zompro, 1996a; Lit & Eusebio, 2008; Dräger, 2012, 2013, 2014; Baker, 2015). Seven new species of the genus *Tisamenus* are added herein and two species were found to be synonyms. This increases the number of known species of Obrimini within the Philippine to 71.

Distribution. – Philippines, Palawan, Borneo, Talaud Islands, Wallacea, Palau Islands and Fiji.

Tribe

Obrimini Brunner v. Wattenwyl, 1893

Type-genus. – *Obrimus* Stål, 1875b: 49.

Remarks. – Obrimini is here reflected as arranged by Bank *et al.* (2021) and illustrated by Hennemann (2023b). All Philippine members with the exception of *Tisamenus* Stål, 1875 have been reviewed by Hennemann (2023b), who also presented keys to all known fourteen genera.

Distribution. – Philippines, Palawan, Borneo, Wallacea (N-Sulawesi and Seram), with single representatives on the Talaud, the Palau Islands and Fiji.

Genera included

1. *Aretaon* Rehn & Rehn, 1939: 419.
Type-species. – *Obrimus asperrimus* Redtenbacher, 1906: 41, by original designation.

2. *Armadolides* Hennemann, 2023b: 11, Fig. 3-6, 72G.
Type-species. – *Eubulides manobo* Acola *et al.,* 2022: 7, by original designation.

3. *Brasidas* Rehn & Rehn, 1939: 430.
Type-species. – *Brasidas samarensis* Rehn & Rehn, 1939: 432, by original designation.
= *Euobrimus* Rehn & Rehn, 1939: 445. (Type-species: *Euobrimus atherura* Rehn & Rehn, 1939: 446, by original designation). [Synonymised by Hennemann, 2023b: 14]

4. *Eubulides* Stål, 1877: 68.
Type-species. – *Eubulides alutaceus* Stål, 1875: 68, by monotypy.

5. *Heterocopus* Redtenbacher, 1906: 42.
Type-species. – *Heterocopus leprosus* Redtenbacher, 1906: 42, by subsequent designation of Rehn & Rehn, 1939: 415.

6. *Mearnsiana* Rehn & Rehn, 1939: 458.
Type-species. – *Mearnsiana bullosa* Rehn & Rehn, 1939: 459, by original designation.
= *Hennobrimus* Conle, 2006: 44. (Type-species: *Hennobrimus hennemanni* Conle, 2006: 45, by original designation) [Synonymised by Hennemann *et al.*, 2016: 18]

7. *Miroceramia* Günther, 1934a: 283.
Type-species. – *Miroceramia pterobrimus* Günther, 1934a: 283 (=*Heteropteryx westwoodii* Bates, 1865: 345), by original designation.

8. *Obrimus* Stål, 1875b: 49.
Type-species. – *Phasma* (*Acanthoderus*) *bufo* Westwood, 1848: 77, by subsequent designation of Kirby, 1904: 398.

9. *Pterobrimus* Redtenbacher, 1906: 43.
Type-species. – *Pterobrimus depressus* Redtenbacher, 1906: 43, by monotypy.

10. *Stenobrimus* Redtenbacher, 1906: 37.
Type-species. – *Stenobrimus bolivari* Redtenbacher, 1906: 37, by monotypy.

11. *Sungaya* Zompro, 1996: 450.
Type-species. – *Sungaya inexpectata* Zompro, 1996: 450, by original designation.

12. *Theramenes* Stål, 1875b: 46.
Type-species. – *Eurycantha olivacea* Westwood, 1859: 65, by monotypy.

13. *Tisamenus* Stål, 1875: 50, 92.
Type-species. – *Tisamenus serratorius* Stål, 1875a: 92, by subsequent designation of Kirby, 1904: 399.
= *Ilocano* Rehn & Rehn, 1939: 460. (Type-species: *Ilocano hebardi* Rehn & Rehn, 1939: 461, by original designation) [Synonymised by Bank *et al.,* 2021: 14]

14. *Trachyaretaon* Rehn & Rehn, 1939: 422.
Type-species. – *Obrimus echinatus* Stål, 1877: 68, by original designation.

Genus ***Tisamenus*** Stål, 1875

Tisamenus Stål, 1875: 50, 92.
Bolívar, 1890: 307.
Kirby, 1904 399. (Designation of type-species)
Redtenbacher, 1906: 43.
Bradley & Galil, 1977: 199.
Zompro, 2004: 206, 322. (Re-established as a valid genus, tribe Eubulidini)
Otte & Brock, 2005: 334.
Lit & Eusebio, 2005b: 208.
Lit, 2020: 326. (Key to species of *Deplanatus* Group)
Bollens *et al.,* 2010: 10.
Hennemann *et al.,* 2016: 19. (Tribe Tisamenini)
Harman, 2022: 20, 23. (Notes on culture stock origins)
Bank *et al.,* 2021: 14. (Tribe Obrimini)
Brock & Büscher, 2022: 521.
Hennemann, 2023b: 128.

Acanthoderus, Westwood, 1848: pl. 38: 5 & 6 (in part).
Westwood, 1859: 53 (in part).

Hoploclonia, Rehn & Rehn, 1939: 464 (in part). (Erroneous synonym)
= *Ilocano* Rehn & Rehn, 1939: 460. (Synonymised by Bank *et al.,* 2021: 14)
Redtenbacher, 1906: 43 (in part).
Bradley & Galil, 1977: 199.
Bragg, 1995: 27.
Zompro, 2004: 208, 312.
Otte & Brock, 2005: 164.
Hennemann *et al.,* 2016: 21.
Bank *et al.,* 2021: 14.

Description. – Very small to medium overall size (body length 18.1-70.0 mm) and stocky to heavy built, usually more or less flattened Obrimini with strongly widened meso- and metapleurae (♀ in particular) and a distinctive more or less raised triangular area in the anterior portion of the mesonotum, that is defined by two posteriorly converging carinae that have the anterolateral angles variously modified, from indistinct nodes to large serrate, denticulate or spinose crests. General body shape moderately elongate and sub-uniform (♂) to distinctly erratic (♀) in diameter; mid portion of metathorax the widest body part with mesothorax often strongly widening towards the posterior (♀ in particular); sexual dimorphism strongly developed. Body surface varying from rather smooth over unevenly granular, nodular or tubercular to strongly spinose; meso- and metanotum with a prominent medio-longitudinal carina or bulge. Colour various tones of brown and mostly rather plain, occasionally with indicated longitudinal markings or stripes of various tones of ochre to dark brown or more rarely orange to russet (more often in ♂). Head rectangular, longer than wide, somewhat flattened with vertex just weakly convex; dorsal armature rather weakly developed if compared to other Obrimini and armed either with spines or tubercles or with post-orbital crests or all three of these, the supra-orbital variably shaped and by far the largest element of cephalic armature; coronals rather weakly developed, mostly tubercular and rarely spinose. Antennae short and not reaching (♀) to slightly projecting over posterior margin of mesonotum (♂); shape generally quite thick, sometimes sub-perlamorph and with antennomeres at best moderately elongated. Scapus slightly compressed dorsoventrally and roundly sub-rectangular in dorsal aspect; pedicellus barrel-shaped and much shorter and narrower; III narrower and about as long as pedicellus; IV much shorter and the following gradually increasing in length with the apical 20 or so joints longest and roughly uniform; consisting of less than 30 joints. Pronotum varying from sub-rectangular or sub-trapeziform to rather broadly transverse; anterior margin usually concave and the transverse median sulcus somewhat displaced towards the posterior and distinctly impressed. Dorsal surface usually with some indication of a raised triangular area; the pre-sulcal area with the anterolateral angles produced into simple or compound tubercles, spines or dentate to serrate crests; these often very prominent and occasionally projecting over anterior margin of pronotum. Mesothorax more or less distinctly widening towards the posterior (more so and often strongly in ♀); mesonotum sub-rectangular and at best 2.7x (♀) or 3.2x (♂) longer

than wide; metanotum notably shorter and also sub-rectangular; both with a distinct medio-longitudinal carina or bulge, which may be discernible in the triangular anterior area of the mesonotum. Lateral margins at best with some nodes or low tubercles and otherwise and occasionally with a variably sized pair of inter-posterior mesonotals. Meso- and metapleurae strongly dilated and expanded, particularly in the posterior supra-coxal portions; mesopleurae with lateral margins varying from tuberculate over denticulate to massively spinose; often the mesopleural spine migrated laterally to such an extend that it is impossible to distinguish from the laterals; the supra-coxal sometimes bifid. Metapleurae even more strongly expanded with lateral margins varying from practically smooth except for the supra-coxal, to strongly dentate or massively spinose; the supra-coxal often forming a very long and strong spine and not rarely bifid. Prosternum with a pair of rounded to slightly elliptical but very prominent sensory area. Meso- and metasternum with a more or less distinct and acute medio-longitudinal carina or keel; mesosternum sometimes tri-carinate with a narrow carinae along each lateral margin; otherwise mostly smooth and at best with a very few small tubercles. Median segment transverse. Abdominal segments transverse in ♀ and sub-quadrate in ♂; II-VI narrowing in ♀, in ♂ roughly uniform in width and diameter. Terga II-IV usually with a variously sized pair of second paired posteriors (more rarely also on V-VII) and occasionally with a variably shaped posterior mesal; II-VII often with a small postero-lateral. Terga VIII and IX usually with a variably shaped posteromedian tubercles, crest or tuberculate, sometimes compound excrescence. Sterna II-VII mostly smooth but occasionally with an indicated medio-longitudinal carina (♂ in particular); praeopercular organ on VII of ♀ indistinct and only represented by a shallow median fold or swelling at posterior margin. Terminalia of ♀: Anal segment declining with posterior margin entire and the lateral margins more or less excavated medially. Epiproct not reaching to tip of epiproct with apex entire, either rounded or obtusely angular; dorsal surface obtusely tectate longitudinally and shape sometimes notably convex. Subgenital plate acutely keeled medio-longitudinally with apical portion narrowing and apex acutely pointed; straight in lateral aspect. Cerci small, compressed laterally and hidden underneath anal segment. Terminalia of ♂: Anal segment with a posteromedian excavation; the epiproct fairly large, scale or shield-shaped and usually extending over apex of anal segment. Poculum in ♂ bulgy, angular with posterior margin broad, labiate and weakly excavated to notched medially. Vomer broad with base transverse and with a short and gently straight to gently curved terminal hook. Legs rather short to moderate in length and varying from slender (mostly ♀) to incrassate; all margins of femora carinated and almost always with dentations; the tibiae usually unarmed and only metatibiae with ventral dentations. Tibiae slightly shorter than corresponding femora. Profemora distinctly constricted in basal half with basal flexure prominent. Medioventral carina of femora very indistinct or wanting. In ♂ metafemora often incrassate basally and with a more or less prominent rounded ventro-basal swelling. Area apicalis of tibiae with a small medio-apical tubercle. Tarsi short and no more than half the length of corresponding tibiae; basitarsus about as long as following two joints taken together.

Egg. – Small to medium-sized for Obrimini (length 2.9-4.7 mm), capsule bulgy to ovoid, sub-circular in diameter, slightly higher than wide and at best 1.7x longer than wide; polar-area rounded. Entire surface of capsule and micropylar plate more or less distinctly sculptured and covered with hairy or fringy structures or short setae, in particular along dorsal margin; capsule mostly covered with a variable network of fringy ridges and carinae. Micropylar plate large and > two-thirds the length of capsule; as typical for Obrimini with a dorsal and two posterolateral extensions and shaped like an inverted Y or T. Median line distinct and reaching to polar area. Operculum oval to circular, flattened and often with an elliptic mount or rim of setae in centre. Colour uniformly greyish or variable tones of brown to russet.

Differentiation. – This very distinctive genus is easily separated from all other Philippine members of the tribe Obrimini by the characteristic more or less raised triangular area in the anterior portion of the mesonotum, that is defined by two posteriorly converging carinae that have the anterolateral angles variously modified, from indistinct nodes to large serrate, denticulate or spinose crests. The prominent anterior armature of the pronotum, stocky overall shape and strongly expanded meso- and metapleurae are shared with *Pterobrimus*, but despite very similar morphology *Pterobrimus* is endemic to the Fiji Islands and can be differentiated by the presence of small scale-like tegmina. *Pterobrimus* also has a triangular mesonotal area, but it is just weakly developed. Eggs most closely resemble those of *Trachyaretao*n in bearing hairy or fringy structures on the operculum and the anterior portion of the capsule, but differ by the much bulgier overall shape, more or less developed net-work of fringy carinae all over the capsule surface, sculpturing of the inner portions of the micropylar plate and more or less pronounced elliptic mount or rim of setae in the centre of the operculum.

Etymology. – *Tisamenus* (lat.) is the latinized version of the Ancient Greek *Tisamenos* (Τισαμενός or *Tisamenós*), a mythological king of Argos and son of Orestes and Hermione, who were the rulers of the Peloponnesus.

Remarks. – *Tisamenus* was originally described by Stål (1875: 50) to comprise the newly described *T. serratorius* Stål, 1875 as well as the two species *Acanthoderus deplanatus* and *Acanthoderus draconinus* described by Westwood (1848), of which Kirby (1904: 399) selected *serratorius* as the type-species. Two further species were added by Bolívar (1890) and another by Redtenbacher (1906), all five species originated from the Philippines. In their extensive treatment of Philippine Obriminae Rehn & Rehn (1939: 464) erroneously interpreted *Tisamenus* as a synonym of *Hoploclonia* Stål, 1875, and described nine new Philippine species in what they referred to as *Hoploclonia*. These authors also provided numerous illustrations of various species as well as a key to the Philippine species. The generic misinterpretation by Rehn & Rehn (1939) was uncovered by Zompro (2004: 206), who re-established *Tisamenus* as a valid genus and thereby transferred all Philippine species described in *Hoploclonia* by Rehn & Rehn to *Tisamenus*. This renders *Tisamenus* as an endemic of the Philippines, whereas *Hoploclonia* is endemic to Borneo (Zompro, 2004: 207; Seow-Choen, 2016: 415). Unfortunately, Zompro did not provide a proper differentiation between these two genera and merely stated that "[…] *the genera differ considerably*" (Zompro, 2004: 207). Two new species and a list of known species was provided by Lit & Eusebio (2005b) and another new species was described by Lit (2010b) along with an updated key to the species of the *Deplanata* group of the genus.

Based on morphological characters Rehn & Rehn (1939) sub-divided the Philippine taxa into four generic groups:

1. *Draconinus* Group (*T. draconinus* (Westwood, 1859), *T. hystrix* (Rehn & Rehn, 1939), *T. lachesis* (Rehn & Rehn, 1939));
2. *Serratoria* Group (*T. serratorius* Stål, 1875, *T. asper* Bolívar, 1890, *T. clotho* (Rehn & Rehn, 1939), *T. atropos* (Rehn & Rehn, 1939));
3. *Deplanata* Group (*T. deplanata* (Westwood, 1848), *T. armadillo* Redtenbacher, 1906, *T. cervicornis* Bolívar, 1890, *T. spadix* (Rehn & Rehn, 1939), *T. tagalog* (Rehn & Rehn, 1939), *T. fratercula* (Rehn & Rehn, 1939));
4. *Polillo* Group (*T. polillo* (Rehn & Rehn, 1939)).

However, these intrageneric groups were not recovered by the molecular approach presented in Bank *et al*. (2021). Effectively, external morphology of the insects basically sub-divides *Tisamenus* into only three groups of similar species, this is 1. the *Serratorius* Group, which comprises the more slender and spinose forms in which the mesothorax is at best slightly widening towards the posterior, 2. the *Deplanatus* Group, which comprises the stockier and less spinose forms

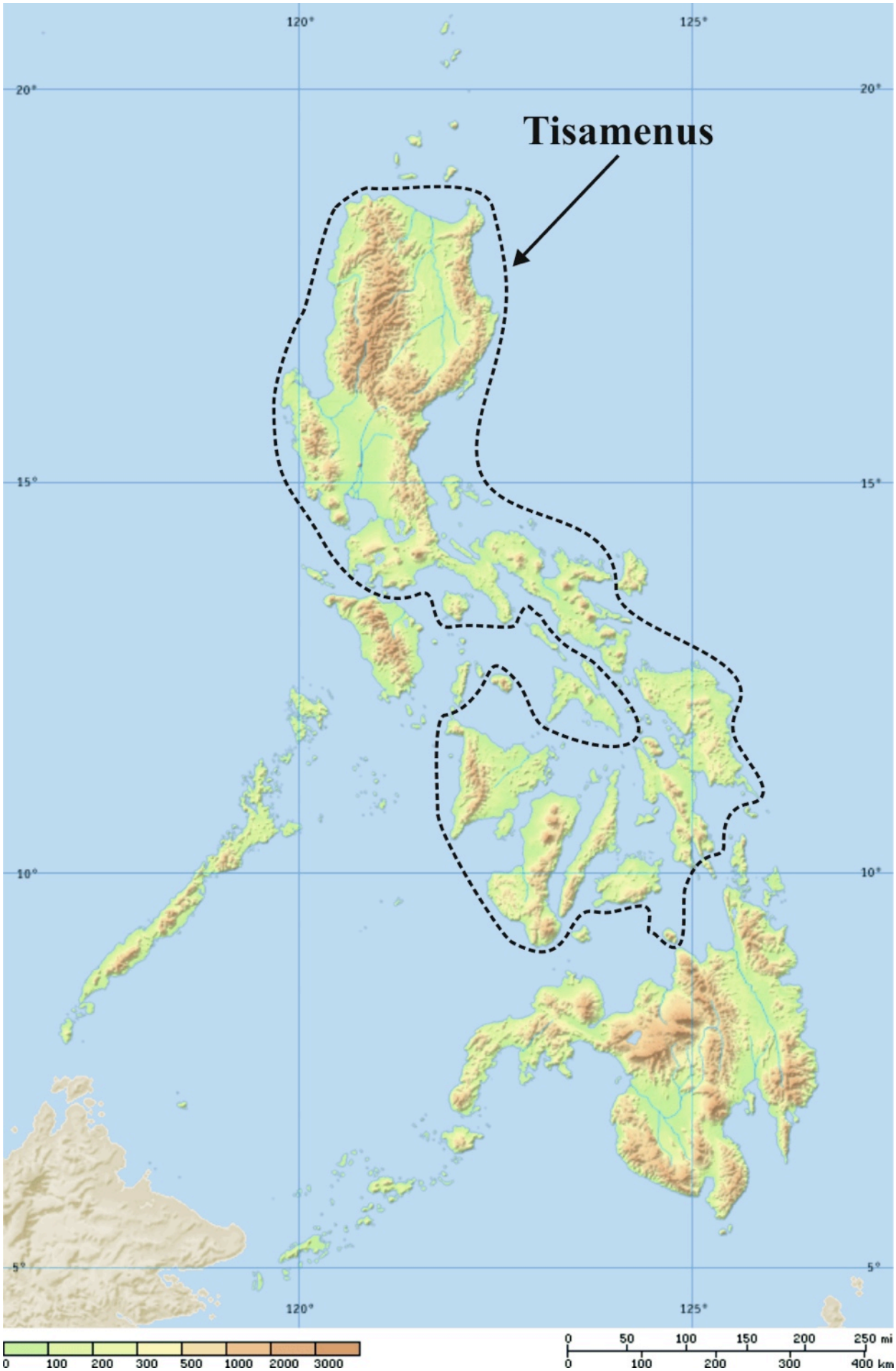

Fig. **2**. Physical map of the Philippine Islands, showing the known distribution of the genus *Tisamenus* Stål, 1875 (Source: Wikipedia Commons. © Eugene Alvin Villar; https://upload.wikimedia.org/wikipedia/commons/6/6f/Ph_physical_map.png)

that have a distinctly trapezoidal mesothorax and mostly lack mesopleural spines except for a single supra-coxal, and 3. The *Ranarius* Group, which comprises the two species that have a strongly reduced mesonotal triangular area and possess an apical tooth or spine on the outer lateral carina of the scapus.

The study of molecular data by Bank *et al.* (2021) also included *Ilocano hebardi* Rehn & Rehn, 1939, the type-species of the Philippine genus *Ilocano*, which resulted as deeply imbedded in *Tisamenus*. Therefore, *Ilocano* was synonymised with *Tisamenus* (Bank *et al.,* 2021: 14). The second species attributed to *Ilocano* by its describers, namely *Acanthoderus ranarius* (Westwood, 1859), was already transferred to *Tisamenus* by Zompro (2004: 207). More detailed morphological examination of *T. hebardi* conducted herein clearly supports the synonymy of *Ilocano* under *Tisamenus* and, including the seven species newly described herein, for now the number of known species stands at twenty-four.

As mentioned above, the systematic position of *Tisamenus* within the Obriminae has varied throughout previous studies. Zompro (2004) combined *Tisamenus* together with *Ilocano*, *Eubulides* and *Heterocopus* in the tribe Eubulidini, which the author characterised by lacking composite posterior meso- and metanotals. Hennemann *et al.* (2016) refused Eubulidini and established the tribe Tisamenini to comprise *Tisamenus*, *Ilocano*, *Hoploclonia* and the Fijian *Pterobrimus*. As some of the characteristics for Tisamenini, Hennemann *et al.* (2016: 20) mentioned the modified anterior area of the mesonotum, distinct medio-longitudinal keel of the meso- and metasternum, prominent and complex anterior armature of the pronotum and short tarsi of the insect as well as the setae and hairy structures frequently seen in the eggs. Moreover, Hennemann *et al.* (2016, fig. 97) interpreted Tisamenini as sister to Obrimini + Miroceramiini. Both arrangements based on morphological characters were yet again refused by a phylogenetic study based on molecular data by Bank *et al.* (2021). Although this latter study provided support for a rather separate and basal position of *Tisamenus* within Obriminae, it has revealed *Tisamenus* as being sister to *Theramenes,* with these to two genera together being sister to the remaining Obriminae (= Obrimini *sensu* Hennemann *et al.,* 2016) with the exception of *Hoploclonia*, *Miroceramia* and *Pterobrimus*.

Distribution (Fig. 2). – Philippines (endemic). Biogeographically, this genus is predominantly restricted to the Greater Luzon Region, which includes the Polillo Islands and Masbate. However, it also has one species on the island of Sibuyan (referred to as a separate biogeographic region), two species in the Greater Negros-Panay Region, one species on the Island of Leyte and one species on Camiguin Island, both of which belong to the Greater Mindanao Region. Therefore, *Tisamenus* can be referred to as largely Luzonian in its natural geographic range.

Rehn & Rehn (1939: 477, pl. 35: 34) recorded *T. deplanatus* (Westwood, 1848) based on a misidentified ♀ from Mindanao (Surigao) and commented "*It is not possible to say whether this specimen came from Surigao, Surigao Province or was picked up at some other point in that province*". Apart from that the specimen actually is a ♀ of *T. cervicornis* (Bolívar, 1890), which is restricted to South Luzon and North Samar, there has not been any other record of the genus *Tisamenus* from the island of Mindanao. It may also be possible, that the record was misspelled and effectively refers to the small island Siargao southeast of Samar, which from biogeographic aspects would be much more likely. Therefore, this record must be regarded as questionable and a distribution of *Tisamenus* on Mindanao presumed as unlikely.

Matsumara & Hirayama (1932) recorded a specimen of *T. draconinus* (Westwood, 1848) from Kotosho Island southeast of Taiwan, but this single record must most certainly be associated to a meteorological event like northing typhoon that are not uncommon in the Luzon Strait, that separates the Philippines and Taiwan. Thus, Taiwan can be excluded from the potential distributional range of *Tisamenus*. More details are to be found in the remarks for *T. draconinus* below.

Species included

1. *Tisamenus alviolanus* Lit & Eusebio, 2010
Distribution. – Negros.

2. *Tisamenus armadillo* Redtenbacher, 1906
Distribution. – "Philippines".

3. *Tisamenus asper* Bolívar, 1890
Distribution. – Central Luzon.

4. *Tisamenes cervicornis* Bolívar, 1890
= *Hoploclonia fratercula* Rehn & Rehn, 1939 **n**. **syn**.
Distribution. – South Luzon, North Samar & Bohol.

5. *Tisamenus charestae* Hennemann & Le Tirant **n**. **sp**.
Distribution. – North Luzon.

6. *Tisamenus clotho* (Rehn & Rehn, 1939)
= *Hoploclonia atropos* Rehn & Rehn, 1939 **n**. **syn**.
Distribution. – Polillo & Luzon.

7. *Tisamenus deplanatus* (Westwood, 1848)
Distribution. – North Luzon.

8. *Tisamenus draconinus* (Westwood, 1848)
Distribution. – East Luzon, Polillo & Leyte.

9. *Tisamenus hebardi* (Rehn & Rehn, 1939)
Distribution. – North Luzon.

10. *Tisamenus heitzmanni* **n**. **sp**.
Distribution. – Cebu.

11. *Tisamenus hystrix* (Rehn & Rehn, 1939)
Distribution. – Sibuyan.

12. *Tisamenus irenoliti* **n**. **sp**.
Distribution. – Marinduque.

13. *Tisamenus kalahani* Lit & Eusebio, 2005
Distribution. – North Luzon.

14. *Tisamenus lachesis* (Rehn & Rehn, 1939)
Distribution. – Polillo, Luzon & North Samar.

15. *Tisamenus makinis* **n**. **sp**.
Distribution. – Luzon.

16. *Tisamenus malawak* **n**. **sp**.
Distribution. – Camiguin.

17. *Tisamenus napalaki* **n**. **sp**.
Distribution. – North Luzon & Palaui.

18. *Tisamenus polillo* (Rehn & Rehn, 1939)
Distribution. – Polillo & Luzon.

19. *Tisamenus ranarius* (Westwood, 1859)
Distribution. – Luzon.

20. *Tisamenus serratorius* Stål, 1875
Distribution. – Luzon.

21. *Tisamenus spadix* (Rehn & Rehn, 1939)
Distribution. – Panay.

22. *Tisamenus summaleonilae* Lit & Eusebio, 2005
Distribution. – Northeast Luzon.

23. *Tisamenus tagalog* (Rehn & Rehn, 1939)
Distribution. – Masbate.

24. *Tisamenus trapezoides* **n**. **sp**.
Distribution. – Luzon.

Keys to the species of *Tisamenus*

♂ *

1. Inter-posterior mesonotal spines present **2**
— No inter-posterior mesonotals **8**

2. Mesopleurae at most with five lateral spines or tubercles **3**
— Mesopleurae with six strong lateral spines (Fig. 40A); Central Luzon . . . . . ***serratorius***

3. Anterolateral angles of mesonotal triangular area with either a compound spine or with two or more spines **4**
— Anterolateral angles of mesonotal triangular area with a simple spine or scarcely protruded **6**

4. Metapleurae with one lateral spine (Fig. 19A); abdominal terga plain; East Luzon, Polillo & Leyte . . . . . ***draconinus***
— Metapleurae with two distinct lateral spines (Fig. 35A); abdominal terga II-V distinctly inflated (Fig. 35I); North Luzon & Palaui . . . . . ***napalaki* n. sp.**

5. Inter-posterior mesonotals and metanotals distinct and more or less spiniform; mesonotal triangular area at best scarcely less than half the length of mesonotum; basal abdominal terga with a posteromedian tubercle or spine **6**
— Inter-posterior mesonotals and metanotals tuberculate and positioned on a distinct conical posteromedian swelling of either segment (Fig. 26C); no posteromedian on basal abdominal terga; Marinduque . . . . . ***irenoliti* n. sp.**

6. Small (body length < 40.0 mm) and stocky; length of mesothorax less than 1.7x width at anterior margin; mesonotal triangular area not longer than width across anterolateral spines of this area (Fig. 24A, D, G); Sibuyan . . . . . ***hystrix***
— Larger (body length > 40.0 mm) and slenderer; length of mesothorax at least 2.2x width at anterior margin; length of mesonotal triangular area notably greater than width across anterolateral spines of that area (Fig. 29A, E, N-O); Polillo, Luzon & Samar . . . . . ***lachesis***

7. Mesonotal triangular area distinct; scapus simple **8**
— Mesonotal triangular area very small and almost indiscernible, only marked by three nodose tubercles (Fig. 45H-I); lateral margins of meso- and metapleurae densely nodose (Fig. 45A, I); scapus with a distinct apical tooth on exterior margin (Fig. 45H-I); Luzon . . . . . ***trapezoides* n. sp.**

8. Mesopleurae at most with five lateral spines or tubercles (occasionally only with a mesopleural) **9**
— Mesopleurae with six lateral spines or tubercles **22**

9. Meso- and metapleural laterals tuberculate or spinose (at least mesopleural represented by a strong spine) **19**
— Meso- and metapleural laterals merely represented as nodes or obscure tubercles, or the lateral margins of meso- and metapleurae minutely granulate to denticulate **10**

10. Mesothorax widening towards the posterior with posterior margin wider than anterior **12**
— Mesothorax with posterior margin not wider than anterior margin; Luzon **11**

11. Very small (body length < 20.0 mm) and stocky (Fig. 21); mesothorax narrowed in posterior portion; Mesopleural laterals distinct; mountainous form . . . . . ***hebardi***
— Larger (body length > 30.0 mm) and very slender form; mesothorax parallel-sided; mesopleural laterals very scarce, nodose; lowland form . . . . . ***kalahani***

12. Anterior pronotals prominent, often bifid or compound; mesopleural supra-coxal present **14**
— Anterior pronotals scarce and only represented by nodes; mesopleural supra-coxal absent **13**

13. Anterolateral spine of pronotum distinct; metapleural supra-coxal spiniform . . . . . ***summaleonilae***
— Anterolateral of pronotum absent (Fig. 31D); metapleural obtuse and angular (Fig. 31A); body armature Wholly reduced (Fig. 31A-B) . . . . . ***makinis* n. sp.**

14. Length of mesothorax greater than width at posterior margin **15**
— Very stocky species (Fig. 32A-D); width of mesothorax at posterior margin greater than length (Fig. 32A); Camiguin . . . . . ***malawak* n. sp.**

15. Mesonotal triangular area not reaching to middle of mesonotum and not longer than width across anterolateral angles, its disc smoothly and evenly concave with an indication of a medio-longitudinal carina **16**
— Mesonotal triangular area reaching to middle of mesonotum and longer than wide, its disc with a more or obvious medio-longitudinal carina **17**

16. Lateral carinae of mesonotal triangular area weakly concave with the anterolateral angles protruded triangularly (Fig. 4D-E); poculum bulgy and obtusely angular, projecting ventrally by about two-thirds the height of anal segment (Fig. 4J) . . . . . ***armadillo***
— Lateral margins of mesonotal triangular area gently convex with the anterolateral angles only tuberculate (Fig. 43C); poculum flattened and scoop-like, projecting ventrally by less than half the height of anal segment (Fig. 43C); Masbatae . . . . . ***tagalog***

17. Posteromedian portion of meso- and metanotum at best slightly rounded **18**
— Meso- and metanotum with a distinct, gibbous posteromedian swelling that bears a pair of nodular inter-posteriors (Fig. 15C); Luzon . . . . . ***deplanatus***

18. Body length ≥ 34.0 mm; metafemora with a distinct rounded ventro-basal swelling (Fig. 7F); South Luzon & North Samar . . . . ***cervicornis***
— Slightly smaller (body length ≤ 34.0 mm); metafemora just obliquely swollen ventro-basally (Fig. 3F); Negros . . . . . ***alviolanus***

19. Stocky species, length of mesothorax no more than 2x width at anterior margin; abdominal segments II-VII not longer than wide (often transverse) **20**
— Very slender species, length of mesothorax > 2.3x width at anterior margin (Fig. 37A-H); abdominal segments II-VII notably longer than wide; Polillo & Luzon . . . . . ***polillo***

20. Mesothorax distinctly widening towards the posterior and distinctly trapezoidal in outline, posterior margin > 1.4x wider than anterior margin and length no more than 1.8x width at anterior margin **21**
— Slenderer species; mesothorax with posterior portion just slightly widened and posterior margin only 1.2x wider than anterior margin, length almost 2x width at anterior margin (Fig. 10A-D); Luzon(mountainous) . . . . . ***charestae* n. sp.**

21. Anterolateral angles of mesonotal triangular area obtusely tubercular (Fig. 12J); all five mesopleural spines Represented by strong spines; metacoxae unarmed; South Luzon . . . . . ***clotho***
— Anterolateral angles of mesonotal triangular area protruded into a large arcuate spine (Fig. 42F); anterior four mesopleural laterals much smaller than mesopleural (Fig. 42A-B); metacoxae with a distinct spine externally (Fig. 42E); Panay . . . . . ***spadix***

22. Mesopleural spines very large and prominent (Fig. 22); Cebu . . . . . ***heitzmanni* n. sp.**
— Mesopleurae spines small tuberculate (Fig. 5C-H); Central Luzon . . . . . ***asper***

* The ♂ of *T. ranarius* (Westwood, 1859) are not known.

♀ *

1. Anterolateral angles of mesonotal triangular area with either a compound spine or with two or more spines **2**
— Anterolateral angles of mesonotal triangular area with a simple spine or scarcely protruded **3**

2. Metapleurae with one lateral spine (Fig. 17A); inter-posteriors of meso- and metanotum distinct and oftencompound (Fig. 17F–G); East Luzon & Polillo . . . . . ***draconinus***
— Metapleurae with two distinct lateral spines (Fig. 33A); inter-posteriors of meso- and metanotum small, Tuberculate and simple (Fig. 33F); North Luzon &Palaui . . . . . *napalaki* **n. sp.**

3. Mesopleurae with six spines along lateral margin **4**
— Mesopleurae with at most five spines along lateral margin **5**

4. Mesonotal triangular area distinctly raised; mesopleurals and metapleural spines strong and spinose (Fig. 39A, C); second paired posteriors of abdominal terga II-IV distinct spinose . . . . . ***serratorius***
— Mesonotal triangular area shallow and rather obscure; mesopleurals and metapleural laterals small tuberculate; second paired posteriors of abdominal terga II-IV only represented by small tubercles (Fig. 5A) . . . . . ***asper***

5. Mesonotal triangular area distinct; scapus simple; abdominal terga without postero-laterals **7**
— Mesonotal triangular area very small and almost indiscernible; scapus with a distinct apical tooth on exterior margin; postero- laterals on abdominal terga present; Luzon **6**

6. Supra-orbitals low, nodose (Fig. 38J); lateral margins od meso- and metapleurae shallowly granular; metapleural small, obtusely tubercular (Fig. 38A, D); tibiae of same colour as corresponding femora . . . . . ***ranarius***
— Supra-orbitals prominent, conical (Fig. 44G); lateral margins of meso- and metapleurae tubercular (Fig. 44A, H); metapleural distinct, sub-spiniform (Fig. 44A, C); tibiae contrastive ochre to clay coloured (Fig. 44A-C) . . . . . ***trapezoides* n. sp.**

7. Meso- and metapleural laterals spinose **8**
— Meso- and metapleural laterals merely represented as nodes or tubercles, or the lateral margins of meso- and metapleurae minutely granulate to denticulate **10**

8. Length of mesonotal triangular area not greater than width across anterolateral spines of this area and not reaching middle of mesonotum **9**
— Length of mesonotal triangular area distinctly greater than width across anterolateral spines of this area and surpassing middle of mesonotum (Fig. 27L, 28F-H; inter-posteriors of meso- and metanotum present or absent); Polillo, Luzon & Samar . . . . . ***lachesis***

9. Stocky species (Fig. 11A-E); anterior portion of mesonotum much broader than pronotum and mesothorax only 1.2x longer than width at anterior margin; no inter-posteriors on meso- and metanotum (Fig. 11C); Luzon ..... ***clotho***

— Slenderer (Fig. 23A–E); anterior portion of mesonotum not noticeably broader than pronotum and length 1.5x width at anterior margin; inter-posteriors of meso- and metanotum distinct (Fig. 23C); Sibuyan ..... ***hystrix***

10. Very small (body length < 32.0 mm); mesothorax roundly rectangular in outline (Fig. 20A); head with supra-orbitals obtusely conical (Fig. 20E); Luzon (mountainous species) ..... ***hebardi***

— Larger (body length > 35.0 mm); mesothorax more or less distinctly widening towards the posterior; head with supra-orbitals tuberculate or spinose **11**

11. Body length > 40.0 mm; abdominal terga II-IV with a tuberculate to spinose pair of second paired posteriors **12**

— Smaller species (body length < 40.0 mm); second paired posteriors of abdominal terga II-IV absent (Fig. 9A-C); Luzon ..... ***charestae* n. sp.**

12. Mesonotal triangular area longer than width across anterolateral spines of this area **13**

— Mesonotal triangular area broader than long or roughly forming an isosceles triangle **15**

13. Mesonotal triangular surpassing middle of mesonotum and with a medio-longitudinal carina on disc, the anterolateral angles moderately protruded and obtuse or multi-tuberculate; metacoxae unarmed **14**

— Mesonotal triangular area evenly concave and without an indication of a medio-longitudinal carina, the anterolateral angle protruded into a distinct arcuate spine (Fig. 41H); metacoxae with a spine externally (Fig. 41C); Panay ..... ***spadix***

14. Anterior pronotals pectinate, multi-spinose (consisting of a distinct anterior spine which is separated by a gap from 3-4 notably smaller posterior spines); meso- and metapleural supra-coxals spinose; carinae of mesonotal triangular area multi-tuberculate (Fig. 36L-M); East Luzon & Polillo ..... ***polillo***

— Anterior pronotals bifid (Fig. 14I); meso- and metapleural tuberculate (Fig. 14A, D); anterolateral angles of mesonotal triangular area protruded into an obtuse conical swelling (Fig. 14I); North Luzon ..... ***deplanatus***

15. Head with supra-orbitals distinct and spinose; pronotal anteriors prominent, spinose and basically bifid **16**

— Head with supra-orbitals obtusely conical; pronotal anteriors compound and obtusely trifid (Fig. 4F) ..... ***armadillo***

16. Body length < 47.0 mm; apex of epiproct narrowed (Fig. 3M); Negros ..... ***alviolanus***

— Body length > 47.0 mm; apex of epiproct obtusely rounded (Fig. 6H); Luzon & North Samar ..... ***cervicornis***

***** The ♀ of *T. heitzmanni* **n. sp.**, *T. kalahani* Lit & Eusebio, 2005, *T. makinis* **n. sp.**, *T. malawak* **n. sp.**, *T. summaleonilae* Lit & Eusebio, 2005 and *T. tagalog* (Rehn & Rehn, 1939) are not known. The ♀ of *T. irenoliti* **n. sp.** is only known from an immature, which can however differ considerably from adults especially in the degree and development of head, body and limb armature. Therefore, this species is here omitted from the key.

Tisamenus alviolanus Lit & Eusebio, 2010
(Fig. 3)

Tisamenus alviolanus Lit & Eusebio, 2010: 328, figs. 2a-f.

HT, ♀: Mt Kanlaon, Sitio Napatagan, Barangay Mailom, Bago City, Negros Occidental, 17-24.vi.2007, P.A. Alviola & E.A. Cosico [UPLB, No. PHA-00137];

AT, ♂: same data as HT [UPLB, No. PHA-00138];

AT, 3 ♀, 1 ♂: same data as HT [UPLB, No's. PHA-00139 to 00142].

- Brock & Büscher, 2022: 521.

- Hennemann, 2023b: 128.

Material examined

1 ♀, Philippinen, Central Visayas, Negros Oriental, Don Salvador Benedicto, local collector V.2012 [FH, No. 1258-1];

2 ♀, **1** ♂, Coll. R.I.Sc.N.B., Philippines, Negros Orient., Dumaguete, IX.2014, local collector, I. Lumawig [RBINS].

Differentiation. – This species is utterly close to the Luzonian *T. cervicornis* Bolívar, 1890 and based on the few known specimens of *alviolanus*, morphological distinction is very difficult, but both sexes are smaller on average than either *cervicornis* and *alviolanus* appears to be geographically separated since it is believed to be endemic on the island of Negros. Females merely differ by the more narrowed apex of the epiproct (Fig. 3M) and ♂ are separable from those of *cervicornis* only by the more pronounced tuberculate mesopleural laterals and the less swollen ventro-basal portion of the metafemora (Fig. 3F). Judging from the illustrations presented by Lit (2010: 329) the eggs are very similar to those of *cervicornis* and only differ by the slightly bulgier overall shape, broader, parallel-sided and more rounded dorsal extension (slightly narrowing towards the apex in *cervicornis*) and comparatively shorter ventro-lateral extensions of the micropylar plate, which do not attain the longitudinal middle axis of the capsule (projecting over middle axis in *cervicornis*).

Remarks. – The four specimens at hand for examination from the collection of RBINS and the collection of the author, differ from the type specimens by the slightly larger dimensions, more distinct and spinose meso- and metapleural supra-coxals and noticeably more pronounced second paired posterior spines of abdominal terga II-V. Moreover, the ♂ from Dumaguete in RBINS has the lateral margins of the mesopleurae rather gently concave than convex in outline like in the allotype. As stated above, and taking the variability possessed by the few specimens available into account, distinction from *T. cervicornis* is close to impossible and the distinctive features mentioned above may well lie within the range of variability of *cervicornis*. It is only the distribution on Negros and the slight differences in egg

Fig. **3**. *Tisamenus alviolanus* Lit & Eusebio, 2010 [RBINS].

A. ♀ dorsal view. **B**. ♀ dorsolateral view. **C**. ♀ lateral view [RBINS]. **D**. ♂ dorsolateral view. **E**. ♂ lateral view. **F**. ♂ ventral view. **G**. Closeup of head and thorax of ♀ in dorsolateral view. **H**. Closeup of head and thorax of ♂ in dorsolateral view. **I**. Closeup of pro-, meso- and metasternum of ♂. **J**. Terminalia of ♂ in dorsal view. **K**. Terminalia of ♂ in ventral view. **L**. Terminalia of ♀ in lateral view. **M**. Terminalia of ♀ in dorsal view [FH 0118-64]. **N**. Terminalia of ♀ in ventral view.

morphology, that induce keeping *alviolanus* as a separate species for now until more specimens become available and even DNA sampling can be conducted. Body lengths of ♀ 44.0-46.8 mm, ♂ 27.4-34.0 mm.

Distribution. – Negros. Province Negros Occidental (Mount Kanlaon, Bago [UPLB – type locality]; Don Salvador Benedicto [FH]); Province Negros Oriental (Dumaguete [RBINS]).

Tisamenus armadillo Redtenbacher, 1906

(Fig. 4, 46A-B)

Tisamenus armadillo Redtenbacher, 1906: 44, pl. 1: 8 (♀).

LT, ♀ (+ 1 egg ex ovipositor): Philippinen, Schadenberg; 694 [SMTD];

PLT, ♀: Philippinen, Schadenberg; 694 [SMTD].

- Bruner, 1915: 230.
- Zompro, 2003: 33. (Type data)
- Zompro, 2004: 206. [**Not**: Figs. 117a-b. Misidentification relating to *T. deplanatus* (Westwood, 1848)]
- Otte & Brock, 2005: 334.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Hoploclonia armadillo, Rehn & Rehn, 1939: 477. (*Deplanata* Group)

- Zompro, 2001: 50, figs.

Material examined

1 ♂: Philippinen, Schadenberg; 694 [SMTD].

Differentiation. – Both sexes of this rarely known species are morphologically very similar to *T. cervicornis* Bolívar, 1890 from South Luzon and Samar and *T. deplanatus* (Westwood, 1848) from Northern Luzon but are smaller and have all the elements of cephalic and body armature somewhat less pronounced and more obtuse. This includes obtusely conical supa-orbitals (Fig. 4F), which are tuberculate to spinose in *cervicornis* and *deplanatus* and obtuse compound anterior pronotals, which are basically trifid (Fig. 4F; spinose and more or less clearly bifid in *cervicornis* and *deplanatus*). From *deplanatus* both sexes additionally differ by the shorter and broader mesonotal triangular area, which is no longer than it is wide across the anterolateral angles, and less medially indented anterior margin of the mesonotum. Males have the emargination of the posterior margin of the anal segment more angular than in *deplanatus* (Fig. 4G), the posterior margin of the poculum is less labiate and less distinctly down-curved, the posteromedian swelling of the meso- and metanotum is less pronounced and lacks the small pair of nodular inter-posteriors seen in *deplanatus* (Fig. 4E) and the disc of the mesonotal triangular area is rather concave and lacks a medio-longitudinal carina. Already Redtenbacher (1906: 449) pointed to the affinity to *deplanatus*, but examination of the type-specimens of *armadillo* has shown the distinguishing features that Redtenbacher mentioned, namely the simplicity of the very strong metapleural supra-coxal and the presence of a pair of spines on the basal abdominal terga, do not hold true for separation of this species from *deplanatus* (and *cervicornis*). The shape of the metapleural supra-coxal is variable in *deplanatus* and in both known ♀ of *armadillo* it is accompanied by a smaller spine, and abdominal terga II-V also bear second paired posterior spines in *deplanatus*. Males are also particularly similar to *T. tagalog* (Rehn & Rehn, 1939) and can merely be distinguished by the somewhat smaller bifid anterior pronotal spines, mesopleural and supra-coxals of the metapleurae, less spinose supra-orbital, slightly concave carinae of the triangular mesonotal area that have the anterior angle triangularly protruded (rather convex with the anterior angle only weakly raised in *tagalog*), larger epiproct that extends notably beyond the posterolateral angles of the anal segment (Fig. 4G), angular and bulgy poculum (Fig. 4J; much flatter and rather scoop-shaped in *armadillo*) and less prominent spines of the posterodorsal carina of the metafemora. The egg (Fig. 46A-B) is closest to that of *deplanatus* but may be distinguished by the more distinctly constricted anterior margin of the capsule and comparatively broader micropylar plate, which has the anterior end in particular broader and less narrowed with the lateral margins of the anterior extension of the plate almost parallel-sided (converging towards a narrow apex in *deplanatus*). Although *armadillo* is morphologically closest to *cervicornis* the eggs are readily separated by the bulgier shape, distinctly constricted anterior margin and lack of the net-like sculpturing of the capsule, considerably larger micropylar plate and lacking the distinct rim of fringes seen on the operculum of *cervicornis*.

Description

♂ (Fig. 4D-E)

Form and colouration. – Size average for the genus (body length 36.0 mm); general form rather stocky, legs fairly strong but not incrassate; elements of armature weakly developed. General colour dark russet, the meso- and metasternum tawny. Antennae orangey brown with the terminal twelve joints ochre.

Head. – Sub-quadrate, scarcely longer than wide with the genae roughly parallel-sided. The three supra-orbitals moderately prominent, conical with the median one largest; occipitals small, rounded and the median and lateral coronals tuberculate and somewhat larger than occipitals. Eyes small, globose and their diameter corresponding to about 0.4x length of gena. Antennae consisting of 26 joints; scapus triangular in dorsal aspect, pedicellus about half the length of scapus and barrel-shaped; III slightly longer than pedicellus, IV much shorter and up to XI slightly increasing in length, then decreasing with the terminal antennomere much elongated and almost as long as three preceding joints taken together.

Thorax. – Pronotum sub-quadrate; triangular area weakly indicated with margins obtusely granular and the anterolateral angles with a strong and conical bifid tubercle (Fig. 4E); transverse median sulcus distinctly indented. Mesothorax slightly widening towards posterior and about 2.1x longer than prothorax. Mesonotum sub-trapeziform with lateral margins slightly convergent towards the posterior and about 2x longer than width at anterior margin; the triangular area rather small, not attaining middle of notum, faintly longer than wide, disk shallowly concave and the weakly concave outer margins anteriorly protruded into an obtuse tubercle; posterior portion of mesonotum with a minutely but densely granulose medio-longitudinal keel. Mesopleurae slightly expanding towards the posterior with laterals merely represented by low rounded tubercles; mesopleural a rather small and simple conical tubercle. Metanotum trapezoidal, scarcely longer than wide and with the same granulose medio-longitudinal keel seen in mesonotum. Metapleurae with laterals sub-obsolete, the metapleural somewhat more pronounced and the supra-coxal angle with a strong but short simple supra-coxal spine (Fig. 4D). Mesosternum tri-carinate with the lateral carinae weaker; metasternum with a shallow medio-longitudinal carina.

Abdomen. – Median segment almost semi-circular in outline, carinate medio-longitudinally and with a small tubercular pair of second paired posteriors. Segments II-VII sub-uniform in length and width, all slightly wider than long; II-V with tuberculate paired second posteriors (very small although on V) and all terga with a fine but fairly acute medio-longitudinal carina which posteriorly terminates in a low tubercle on II-VII; on VI and IX the carina is increasingly elevated and posteriorly protruded into a rather conical swelling. Basal sterna with an indicated medio-longitudinal carina. Anal segment strongly declining and somewhat narrowed posteriorly with the lateral margins angular and the dorsal surface with an obtuse medio-longitudinal carina; posterior margin with a shallow, rounded median excavation and the outer angles obtusely protruded. Epiproct transverse, roundly rectangular and notably projecting beyond anal segment (Fig. 4G). Poculum angularly cup-shaped with a broad and labiate posterior flange, that is slightly down-curved and reaches about halfway along anal segment (Fig. 4J).

Legs. – Moderately stocky with the femoral teeth fairly distinct and acutely triangular; the dorsal ones of the metafemora decreasing in size towards apex of femur and the three terminal teeth on ventral carinae strong, spinose and roughly uniform in size. Pro- and mesofemora somewhat shorter than mesothorax,

Fig. **4**. *Tisamenus armadillo* Redtenbacher, 1906 [SMTD © Christian Schmidt].

A. ♀ PLT dorsal view. **B**. ♀ PLT lateral view. **C**. ♀ LT lateral view. **D**. ♂ dorsal view. **E**. ♂ lateral view. **F**. Closeup of head and thorax of ♀ LT in dorsolateral view. **G**. Terminalia of ♂ in dorsal view. **H**. Terminalia of ♀ LT in dorsal view. **I**. Terminalia of ♀ LT in lateral view. **J**. Terminalia of ♂ in lateral view.

metafemora reaching one-third along abdominal segment VI and metatibiae projecting beyond tip of abdomen by about the combined length of two terminal terga. Ventro-basal swelling of metafemora distinct, sub-globose. Metatibiae smooth dorsally and with 3-4 small teeth ventrally. Basitarsi almost as long as following three tarsomeres taken together.

Measurements [mm]. – Body 36.0, pronotum 4.2, mesonotum 7.7, metanotum 4.1, median segment 2.2, profemora 8.5, mesofemora 6.9, metafemora 9.3, protibiae 7.2, mesotibiae 6.6, metatibiae 9.7, antennae *ca.* 15.0.

Egg (Fig. 46A-B)

Of moderate size for the genus; capsule barrel-shaped and bulgy with a distinct and broad constriction of the anterior portion and a very scarcely flattened polar-area, oval in cross-section and notably higher than wide; the capsule 1.5x longer than wide. Entire surface minutely pitted and with irregularly dispersed by fairly sparse clusters of small, fringy excrescences that are most numerous in the polar region and below the anterior constriction of the capsule. Micropylar plate very large and almost 0.85x as long as capsule; clearly Y-shaped with the median portion fairly slender, almost uniform in width and reaching to the lower margin of the anterior constriction of capsule; the two posterolateral extensions slightly wider in the median portion with the apex somewhat narrowed and on lateral surfaces slightly projecting over axis of egg capsule; the posterior portion 90° V-shaped with a small bowl-shaped micropylar cup in centre. Outer margin marked by a fairly narrow and shallow ridge, the interior portion somewhat raised and essentially sculptured like capsule; the area in between forming a slightly indented rim that is destitute of any notable sculpturing. Median line an indistinct slender carina that almost reaches to the polar area. Operculum slightly elliptical and flattened with only a shallow collar of fringy protuberances at outer margin and a broad ring of

similar protuberances interiorly, the central area indented with a small central protuberance. Colour mid brown with the constricted anterior portion of capsule, outer margin of micropylar plate and operculum dark brown. Measurements [mm]: Length incl. operculum 3.6, length 3.6, width 2.4, height 2.8, length of micropylar plate 3.0.

Remarks. – Redtenbacher (1906: 44) described *T. armadillo* from two ♀ in the collection of SMTD. A lectotype (Fig. 4C) was selected by Zompro (2003: 33), who extracted an egg from the ovipositor of the specimen (Fig. 46A-B). The additional ♂ in the collection of SMTD is apparently conspecific to the two ♀ types but cannot be regarded part of the type series because Redtenbacher (1906: 44) did not mention any ♂ in the original description (Fig. 4D-E). Descriptions and illustrations of the previously unknown ♂ and egg are presented herein based on this specimen. Unfortunately, there is no definite information as to the exact locality in the Philippines from which came rarely known species was collected. Zompro (2004: 206, Fig. 117a-b) recorded *armadillo* based on a ♂ and ♀ from the Ilocos Region of Northwest Luzon in the collection of SMTD, but these two specimens actually represent *T. deplanatus* (Westwood, 1848). Body length of ♀ 48.0 mm.

Distribution. – Philippines [SMTD – type locality].

Tisamenus asper Bolívar, 1890

(Fig. 5)

Tisamenus asper Bolívar, 1890: 308.

LT, ♀ (by present designation): Monte de Angat, Marzo !; *Tisamenus asper* Bolivar; MNCN, Cat. Tipos N° 1598; *Tisamenus asper* ♀ Bolivar 1890, LECTOTOYUS, O. Zompro VII.2001 [MNMS];

PLT, ♂: Sintipo ?; MNCN Cat. Tipos N° 1599 [MNMS].

- Kirby, 1904: 399.
- Redtenbacher, 1906: 45.
- Bruner, 1915: 230.
- Paris, 1994: 169.
- Zompro, 2004: 206.
- Otte & Brock, 2005: 334.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Hoploclonia aspera, Rehn & Rehn, 1939: 473. (*Serratoria* Group)

Material examined

1 ♂: Philippinen, Zentral Luzon Id., Provinz Bulacan, Norzagaray Munip., local collector 16.VI.2012 [coll. FH, No. 1544-1].

1 ♂: Philippinen, Zentral Luzon Id., Provinz Quezon, General Nakar Munip., Minahan, local collector VII.2004 [coll. FH, No. 1544-2].

Differentiation. – This species is morphologically most similar to *T. deplanatus* (Westwood, 1859) and *T. cervicornis* Bolívar, 1890 but differs from both these species by the slightly slenderer shape, having six distinct tuberculate mesopleurals (Fig. 5A, C, E; only a definite anterior and posterior mesopleural present in *deplanatus* and *cervicornis*), having the anterior pronotals weakly developed and obtusely tubercular in shape (Fig. 5L; distinctly spinose in *deplanatus* and *cervicornis*), the pair of posteriors on abdominal terga II-IV only represented by small, obtuse tubercles (distinct spines in *deplanatus* and *cervicornis*) and the carinae of the mesonotal triangular area just weakly developed, shallow and becoming increasingly scarce towards the posterior. In having the mesonotal triangular area fairly large, noticeably longer than wide and surpassing the middle of the mesonotum, *asper* resembles *deplanatus*, but as stated above the outer carinae of this area are much less pronounced and not forming distinct ridges with the anterior angles triangularly protruded as in *deplanatus*.

Remarks. – Bolívar (1890: 308) described this species from a ♀ and ♂ in the collection of MNMS (Fig. 5A-D), of which the ♀ (Fig. 5A-B) is here selected as the lectotype to ensure stability of the name. Not having examined Bolivar's type specimens Rehn & Rehn (1939: 473) attributed this species to the *Serratoria* group, but actually *asper* is morphologically much closer to species that these authors placed in their *Deplanatus* group, i. e. *T. deplanatus* or *T. cervicornis*. Body lengths ♀ 50.0 mm, ♂ 38.8-41.0 mm.

Distribution. – Central Luzon. Province Bulacan (Angat [MNMS – type locality]; Norzagaray [FH]); Province Quezon (General nakar Municipality, Minahan [FH].

Tisamenus cervicornis Bolívar, 1890

(Fig. 6-8, 46C-D)

Tisamenus cervicornis Bolívar, 1890: 307, pl. 19: 5, 5a (♀).

LT, ♀ (by present designation): Camarines, Mazarr; *Tisamenus cervicornis* Bolivar; Sintipo; MNCN, Cat. Tipos N° 1596; [MNMS];

PLT, ♂: Camarines, Mazarr.; *Tisamenus cervicornis* Bolivar; Sintipo; MNCN, Cat. Tipos N° 1597; *Tisamenus cervicornis* ♂ Bolivar 1890, LECTOTOYUS, O. Zompro VII.2001 [MNMS].

- Kirby, 1904: 399.
- Redtenbacher, 1906: 44.
- Bruner, 1915: 229.
- Paris, 1994: 169.
- Zompro, 2004: 206.
- Otte & Brock, 2005: 334.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Hoploclonia cervicornis, Rehn & Rehn, 1939: 478. (*Deplanata* Group)

Hoploclonia deplanata, Rehn & Rehn, 1939: 477, pl. 35: 34 (♀). (*Deplanata* Group) (Misidentification)

Tisamenus deplanata, Dräger, 2012: 14, fig. 23-25. (Misidentification)

= *Hoploclonia fratercula* Rehn & Rehn, 1939: 481, pl. 31: 5 (♂).

HT, ♂: Butucan, Tayabas, Luzon, Philippines (W. Boettcher); X. 4.1916; *Hoploclonia fratercula* Rehn + Rehn, Type, H.1253; Data Base Serial No. Assigned as Type No. September 2008. Type # 9126 [ANSP]. **n**. **syn**.

- Otte, 1978: 79. (Type data)

Tisamenus fratercula, Zompro, 2004: 206

- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Material examined

2 ♀, **1** ♂, **2** eggs: Coll. R.I.Sc.N.B., Philippines, Pocdol Mts, Ex breeding 2015 Rob Krijns [RBINS];

2 ♂: Coll. R.I.Sc.N.B., Philippines, Luzon, Bicol, Pocdol Mts, ex breeding 2014 F4, B. Kneubühler [RBINS];

1 ♀, **1** egg: Philippinen, S Luzon Island, Provinz Quezon, Tayabas, Mount Banahao, local collector II.2010 [FH, No. 0905-8 & E2];

1 ♀: Philippinen, S Luzon Id., Bicol Region, Provinz Sorsogon, Pocdol Mountains, local collector XI.2011 [FH, No. 0905-9];

3 ♀, **1** ♂: Ex Zucht F. Hennemann 2017, Herkunft: Philippinen, Luzon, Bicol Reg., Pocdol Mts., Mount Pulog X.2009 [FH, No.'s 0905-1 to 4];

2 ♀, **2** ♂, **2** eggs: Philippinen, S-Luzon, Bicol Region, Provinz Albay, Mount Mayon, Tabaco, local collector II.2011 [FH, No's 0905-5 to 7, 18, E1];

3 ♀, **5** ♂, **1** ♀ (penultimate instar): Philippinen, SO Luzon Id., Caramoan Peninsula, Prov. Camarines Sur, Lagonoy, local collector II.2012 [FH, No's 0905-13 to 16, 19 to 22];

1 ♀, **2** ♂: Philippinen, S Luzon Id., Bicol Region, Provinz Sorsogon, Mount Bulusan, local collector II.2013 [FH, No's 0905-10 to 12];

1 ♀, **1** ♂: Philippinen, S-Luzon, Bicol Region, Provinz Albay, Tiwi, local collector I.2011 [FH, No's 0905-23 & 24];

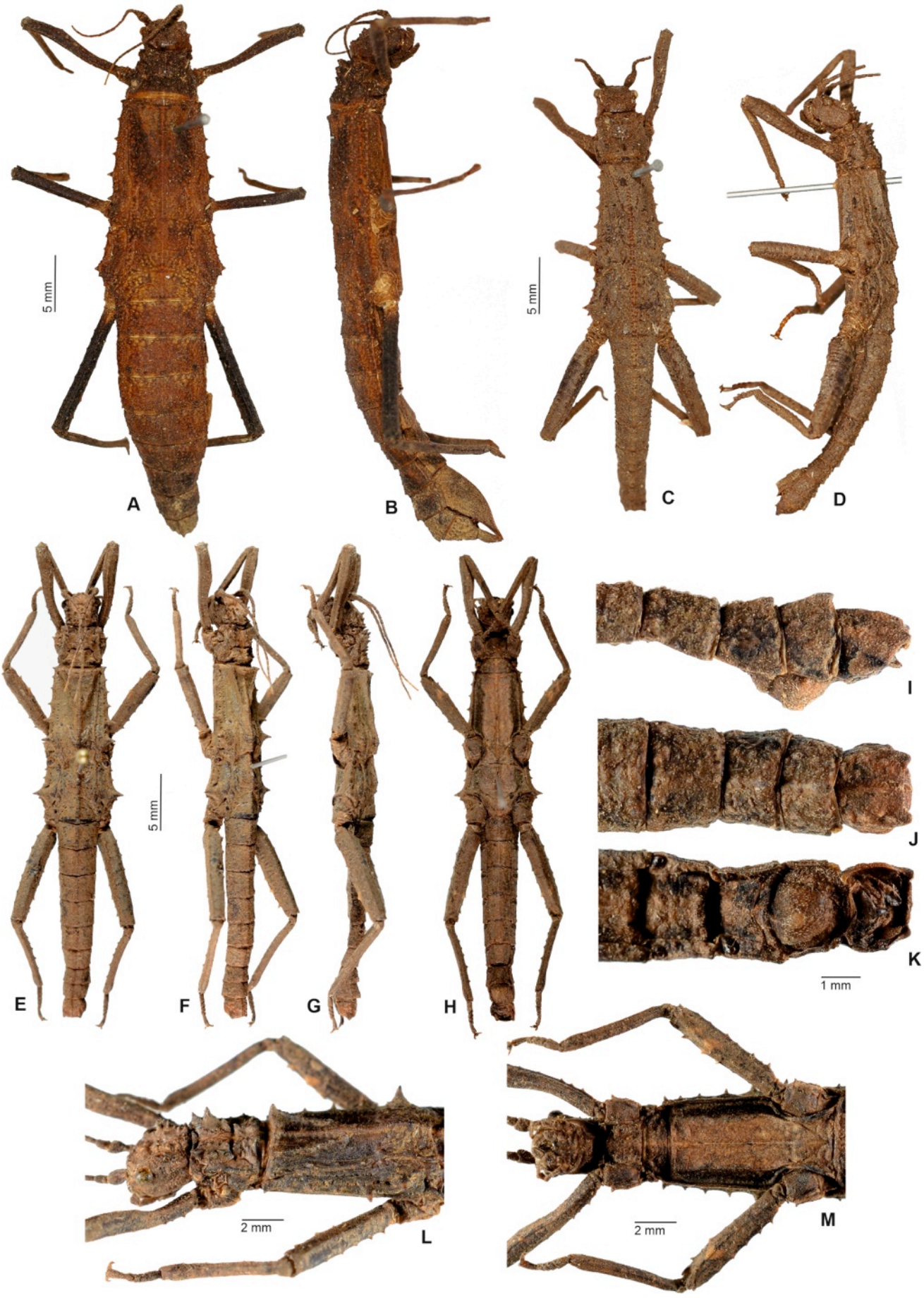

Fig. **5**. *Tisamenus asper* Bolívar, 1890.

A. ♀ LT dorsal view [MNMS]. **B**. ♀ LT lateral view [MNMS]. **C**. ♂ PLT dorsal view [MNMS]. **D**. ♂ PLT lateral view [MNMS]. **E**. ♂ dorsal view [FH 1544-1]. **F**. ♂ dorsolateral view [FH 1544-1]. **G**. ♂ lateral view [FH 1544-1]. **H**. ♂ ventral view [FH 1544-1]. **I**. Terminalia of ♂ in lateral view [FH 1544-1]. **J**. Terminalia of ♂ in dorsal view [FH 1544-1]. **K**. Terminalia of ♂ in ventral view [FH 1544-1]. **L**. Closeup of head and thorax of ♂ in dorsolateral view [FH 1544-1]. **M**. Closeup of pro-, meso- and metasternum of ♂ [FH, No. 1544-1].

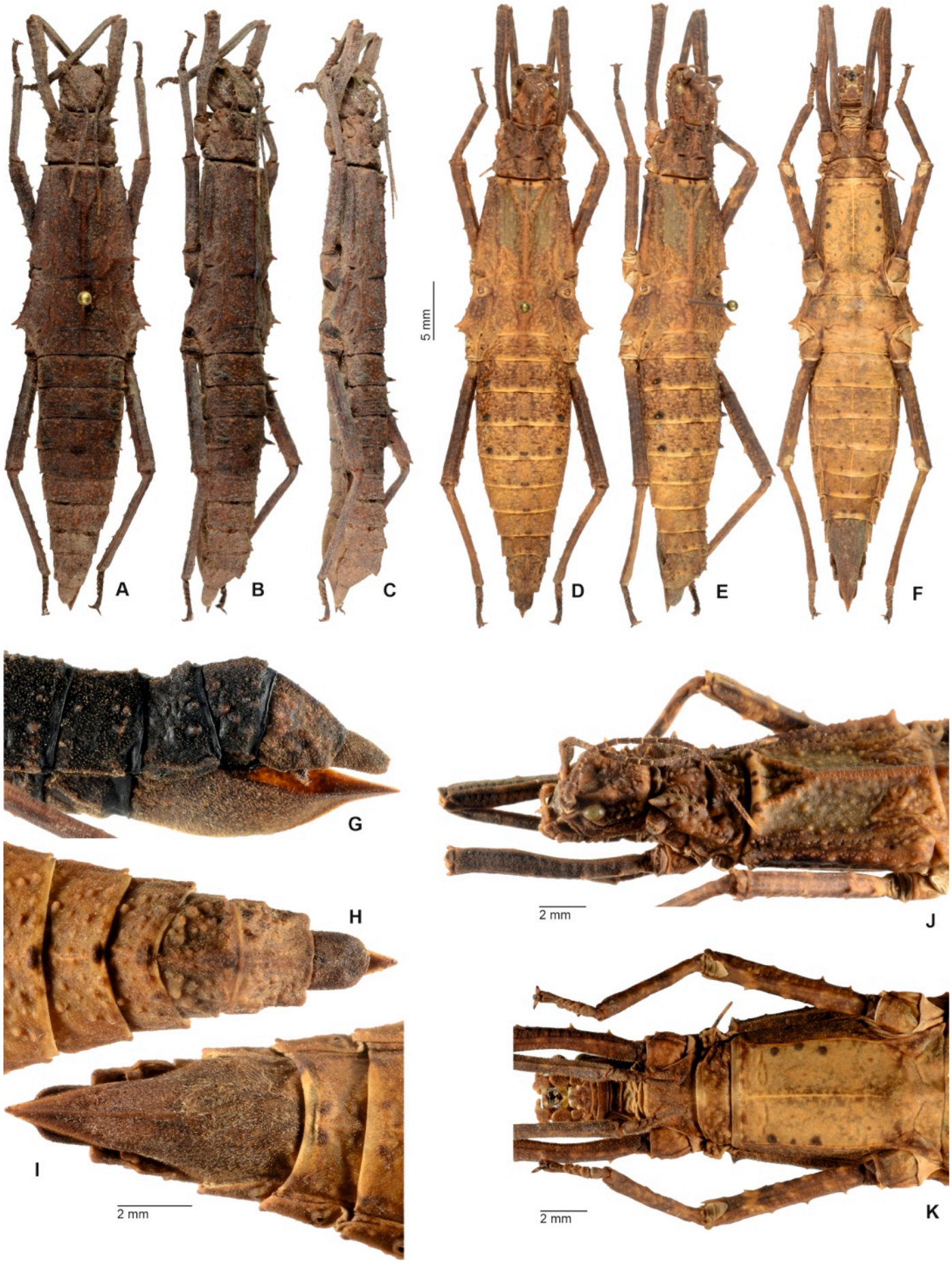

Fig. **6**. *Tisamenes cervicornis* Bolívar, 1890 ♀.

A. Dorsal view [FH 0905-9]. **B**. Dorsolateral view [FH 0905-9]. **C**. Lateral view [FH 0905-9]. **D**. Dorsal view [FH 0905-1]. **E**. Dorsolateral view [FH 0905-1]. **F**. Ventral view [FH 0905-1]. **G**. Terminalia in lateral view. **H**.Terminalia in dorsal view. **I**. Terminalia in ventral view. **J**. Closeup of head and thorax in dorsolateral view [FH 0905-1]. **K**. Closeup of pro-, meso- and metasternum [FH 0905-1].

Fig. **7**. *Tisamenes cervicornis* Bolívar, 1890 ♂.

A. Dorsal view [FH 0905-4]. **B**. Dorsal view [FH 0905-7]. **C**. Dorsolateral view [FH 0905-7]. **D**. Lateral view [FH 0905-7]. **E**. Ventral view [FH 0905-7]. **F**. Anteroventral view of left hind leg. **G**. Terminalia of ♀ in dorsal view. **H**. Terminalia in ventral view. **J**. Closeup of head and thorax in dorsolateral view [FH 0905-7].

1 ♀, **1** ♀ (penultimate instar): Philippinen, Eastern Visayas, N-Samar Id., Prov. Northern Samar, Lope de Vega, local collector V.2012 [FH, No's 0905-25 & 26];

1 ♀, **1** egg: Coll. R.I.Sc.N.B., Philippines, Eastern Visayas, Samar, Lope de Vega [RBINS].

Differentiation. – This species is morphologically closest to *T. deplanatus* (Westwood, 1848) but slightly smaller on average and slightly stockier. Both sexes can easily be separated by the notably smaller mesonotal triangular area (Fig. 6J, 7L), which covers less than half the length of the mesonotum and is not longer than it is wide across the anterolateral angles, particularly in ♀ however where it is an isosceles triangle and covers scarcely more than one-third of the mesonotal length. Males may also be distinguished from those of *deplanatus* by having the posteromedian portion of the meso- and metanotum flattened (Fig. 7D; gibbous in *deplanatus*) and the vomer with the hook arched towards the left (Fig. 7H; backward-directed in *deplanatus*) and ♀ can be distinguished by the rather flattened, just weakly longitudinally convex epiproct (Fig. 6G; distinctly gibbous in *deplanatus*). Moreover, the eggs (Fig. 46C-D) are less bulgy than those of *deplanatus* and readily differ by having the capsule surface much more prominently sculptured and covered with a prominent raised network of fringy ridges, and the micropylar plate being noticeably shorter than the capsule with the anterior extension about equal in length to the two posterolateral extensions (much longer in *deplanatus*). From the very similar *T. armadillo* Redtenbacher, 1906 both sexes of this species differ by the on average larger size, generally more pronounced head and body armature including spinose supra-orbitals on the head (Fig. 6J; obtusely conical in *armadillo*) and prominent and spinose and bifid anterior pronotals (compound and obtusely conical in *armadillo*). The eggs clearly differ from those of *armadillo* by the slightly more elongate shape, distinct net-like sculpturing of the capsule, noticeably smaller micropylar plate and characteristic rim of fringes on the operculum. As stated for

Fig. **8**. *Tisamenes cervicornis* Bolívar, 1890 Live captive reared insects from Mount Pulog, Pocdol Mountains, Bicol region. **A**. Mottled colour variety of ♀. **B**. ♂. **C**. Closeup of head, pro- and mesonotum of ♀. **D**. Couple.

T. alviolanus Lit & Eusebio, 2010 above, distinction between these two species is very difficult and *alviolanus* is here not synonymised with *cervicornis* only because of its distribution and possible endemicity on the island of Negros and slight differences in the egg morphology as well as the more narrowed apex of the epiproct in ♀ if compared to *cervicornis*.

Egg (Fig. 46C-D). – Average size for the genus; capsule oval with the posterior one-third somewhat narrowed, slightly oval in cross-section and notably higher than wide with central dorsal surface bulgy; capsule 1.4x longer than wide. Surface minutely granular and all over covered by a fairly dense but uneven raised network of fringy ridges; the lots between the ridges largest below anterior margin of capsule. The anterior margin somewhat inflated and covered by a broad rim of fringy structures. Micropylar plate fairly short and only about 0.7x the length capsule; basically Y-shaped with the median portion small, slightly narrowing towards the anterior end staying far below anterior margin of capsule, the two posterolateral extensions however large, extending on lateral surfaces of capsule almost at an angle of 90° and clearly surpassing longitudinal axis of egg. Outer margin marked by a distinctly raised fringy bulge and the inner portion raised and densely but unevenly covered with fringy structures. Posterior portion widely V-shaped with a distinct bowl-shaped micropylar cup in centre. Median line indistinct and very short. Operculum slightly oval; the outer margin with a rim of fairly long-fringe-like appendages and in centre with a circular, distinctly raised rim that is covered by similar but even longer fringes than those seen on the outer margin. General colour plain ochraceous mid brown to sepia brown, the fringes of the raised network of the capsule more yellowish tone and the outer margin of the micropylar plate as well as the micropylar cup darker brown. Measurements [mm]: Length incl. operculum 3.9, length 3.5, width 2.5, height 2.8, length of micropylar plate 2.5.

Variability. – There is not too much morphological variability seen in *cervicornis*. The examples from the island of Samar are all on the smaller side of the size range of the species. Essentially all elements of cephalic, thoracic and abdominal armature are subject to slight variability, which however mostly restrict to the size of the individual spines, which also concerns to the spines of the hind legs in ♂. In ♀ the second paired posteriors are always present on abdominal terga II-IV but in some samples, there is an additional, smaller pair on tergum V (e. g. the specimens from Tiwi, Lagonoy, Mount Banahao and Mount Mayon). This is also the case in two of the ♂ from Lagonoy and one of the captive reared ♂ from the Pocdol Mountains has all second paired posteriors notably reduced and only represented as rather obtuse tubercles. While the pronotal anteriors are frequently bifid, there is an additional but smaller third posterior spike in a ♀ sample from Pocdol Mountains. Body lengths ♀ 47.5-53.0 mm, ♂ 34.0–37.0 mm.

Remarks. – Bolívar (1890) described this species from two syntypes in the collection of MNMS, of which the ♂ bears a lectotype label attached to the specimen by Zompro. The type-status has however never been published. Since the ♀ is the more complete specimens and was illustrated by Bolívar (1890: pl. 5, 5a) it is here designated as the lectotype to ensure stability of Bolívar's taxon and the new synonymy introduced. Examination of the holotype of Rehn & Rehn's *fratercula*, a species described based on a unique ♂ from Tayabas or Butucan in the Quezon Province, as well as a good series of specimens from various localities including the type-locality of *fratercula* in the collections of RBINS and the author and taking the intraspecific variability into account leave no doubt *fratercula* is the same species as *cervicornis* and thus a synonym (**n**. **syn**.). Three examples from Lope de Vega in the collections of RBINS and the author represent the first record of *cervicornis* from the island of Samar. The egg is here formally described for the first time and illustrated (Fig. 46C-D).

Rehn & Rehn (1939: 477, footnote 84) recorded *T. deplanatus* from "Surigao" at the extreme north-eastern tip of Mindanao based on a ♀ in the USNM collection but stated that it was not possible to say whether the specimen came from Surigao, Surigao Province or was picked up at some other locality in that province. All records of *deplanatus* however are from Northern Luzon and this ♀ at first glance differs from true *deplanatus* by the much smaller triangular mesonotal area. Unfortunately, the USNM specimen was only examined from the illustration provided by Rehn & Rehn (1939, pl. 35: 34), which actually shows it to be misidentified and to come morphologically closest to *cervicornis*, which is distributed in South Luzon and is also known from the island of Samar, that is situated between Luzon and Mindanao. However, since there are no other known records of *Tismaenus* from the island of Mindanao, this locality must for now be regarded as questionable.
Culture stock of this species has originally been misidentified and was erroneously distributed as "*Tisamenus deplanata* 'Pocdol'. The first specimens were collected by Thierry Heitzmann (Philippines) in 2010 on Mount Pulog, Pocdol Mountains, Sorsogon province, Bicol, South Luzon. Further specimens were found in November of the same year on Mount Osiao, a peak in the same mountain range (Dräger, 2012: 14). Eggs have been sent to Europe on several occasions and Bruno Kneubühler (Switzerland) appears to been among the first enthusiasts to successfully breed *T. cervicornis* on bramble (*Rubus* pp., Rosaceae) in Europe. It has since proven very easy to maintain in culture and has been attributed culture No. 399 by the Phasmid Study Group.

Distribution. – S-Luzon: Bicol Region: Province Camarines Sur [MNMS – type locality]; Caramoan Peninsula, Lagonoy [FH]). Bicol Region: Province Sorsogon (Pocdol Mountains, Mount Pulog [FH, RBINS]; Mount Osiao (Dräger 2012: 14)). Bicol Region: Province Albay (Mount Mayon, Tabaco [FH]; Tiwi [FH]; Guinobatan [photographic record by Albert Kang: https://inaturalist.ca/observations/61550236]). Province Quezon (Tayabas, Butucan [ANSP – type locality]; Tayabas, Mount Banahao [FH]; Ligao [photographic record by Albert Kang: https://www.jungledragon.com/image/53972/stick_insect_phasmid_-_tisamenus_deplanata.html]). N-Samar: Province Northern Samar (Lope de Vega [FH, RBINS]). Bohol: Bilar [photographic records: https://inaturalist.ca/observations/127496027, https://inaturalist.ca/observations/127496017].
The record from Surigao, Mindanao by Rehn & Rehn (1939: 477) based on a specimen in the collection in USNM is doubtful (see above and remark on distribution of the genus *Tisamenus*).

Tisamenus charestae Hennemann & Le Tirant **n**. **sp**.

(Fig. 9-10, 46E-F)

ZooBank: https://zoobank.org/787B4F6A-9983-4102-ADC1-E39874880FC4

HT, ♀: Philippines, N Luzon Id., Province Ifugao, Central Cordillera, Cambulo trail, 1750 m, local collector 24.III.2021 [IMQC].

PT, **2** ♀, **1** ♂: Philippines, N Luzon Id., Province Ifugao, Central Cordillera, Cambulo trail, 1750 m, local collector 24.III.2021[IMQC].

PT, **7** ♀, **2** ♂, **1** egg (ex ovipositor): Philippinen, N Luzon Id., Provinz Ifugao, Central Cordillera, Cambulo trail, 1750 m, local collector 24.III. 2021 [FH, No's 1355-1 to 9 & E].

PT, **1** ♀, **1** ♂: Coll. R.I.Sc.N.B., Philippines, N Luzon Id., Provinz Ifugao, Central Cordillera, Cambulo trail, 1750 m, local collector 24.III.2021 [RBINS].

PT, **1** ♀, **1** ♂: Ifugao, Philippines, leg. Heitzmann 2014 [TB].

Differentiation. – Both sexes are morphologically closest to *T. polillo* (Rehn & Rehn, 1939) but may be separated by the smaller size, slightly stockier overall shape and limbs (Fig. 9A–D, 10A-D). Males may also be differentiated by stronger and less pointed supra-coxals of the meso- and metapleurae, having the anterior pronotals represented by two large just slightly unequally sized spines (Fig. 10F; tri-spinose in *polillo* with the spines notably decreasing in size towards the

Fig. **9**. *Tisamenus charestae* **n. sp.** ♀ PT's.

A. Dorsal view [FH 1355-2]. **B**. Dorsolateral view [FH 1355-2]. **C**. Lateral view [FH 1355-2]. **D**. Ventral view [FH 1355-2]. **E**. Closeup of head, pro- and mesonotum [FH 1355-1]. **K**. Closeup of pro-, meso- and metasternum [FH 1355-2]. **G**. Terminalia in lateral view. **H**. Terminalia in dorsal view. **I**. Terminalia in ventral view.

posterior), having the armature of the limbs comparatively more pronounced and the smaller epiproct (Fig. 10H). Females of this new species are moreover distinguishable from those of *polillo* by the much shorter, conical and rather tubercular than spinose supra-coxals of the meso- and metapleurae, notably smaller sub-obsolete mesopleurals (more or less spinose in *polillo*), smaller dentations of the outer margins of the mesonotal triangular area (Fig. 9E), having the paired posteriors of the abdominal terga II-IV merely represented as small tubercles (distinct spines in *polillo*), as well as the longer subgenital plate that extends beyond the epiproct by more than half of whose length. Due to the reduced body armature ♀ also show similarity affinity to those of the Luzonian *T. asper* Bolivar, 1890 and *T. cervicornis* Bolívar, 1890 but differ from both species by the smaller size, much slenderer general shape and more elongate limbs (Fig. 9A-D). From the first they differ by the smaller laterals of the meso- and metapleurae, which are only represented by obtuse tubercles (small spines in *asper*), more spinose cephalic and prothoracic armature (Fig. 9E), more distinctly raised carinae of the mesonotal triangular area (Fig. 9E) and the longer subgenital plate, which projects notably beyond the epiproct (Fig. 9G-H). From *cervicornis* they are easily separable by the larger mesonotal triangular area which attains the middle of the mesonotum (Fig. 9E), less acute and comparatively smaller supra-coxals of the meso- and metapleurae, lack of the paired posterior spines of abdominal terga I-IV and longer antennae, which project beyond the tip of the protibiae. The eggs are characteristic for the small micropylar plate, which has all three

extensions rather short and corresponds to only about two-thirds of the capsule length (Fig. 46E).

Etymology. – This small new species is named after Sonya Charest, the head of education of the Montréal Insectarium (IMQC) for over 30 years and long-term colleague and friend of the second author. She was also involved in the Monarch Watch programme and this species is named after her to honour her enormous efforts for entomological education and various other projects at the Montréal Insectarium, the largest insect museum in Canada.

Description

♀ (Fig. 9)

Form and colouration. – Size small (body length 38.0-43.0 mm), general form slender and elongate, the elements of armature rather weakly developed and the legs slender and elongate. Body surface unevenly granular. General colour mid to dark brown or almost black, often with a slight orangey to reddish wash in lighter specimens; most of the larger elements of armature blackish and the medio-longitudinal keel of the thorax and mesonotal triangular area russet. Sterna somewhat lighter in colour. Antennae with two basal segments coloured like body, the following reddish mid brown and the 4-5 terminal joints rather ochraceous.

Head. – Sub-quadrate and scarcely longer than wide with the genae parallel-sided and the vertex gently convex medio-posteriorly. Supra-orbitals represented by two moderately prominent elongate tubercles, the anterior one of which is notably larger than the second (Fig. 9E); occipitals much lower and tuberculate; the four occipitals somewhat more pronounced than occipitals and bifid with the lateral coronals larger than medials. Surface otherwise irregularly tuberculate and genae with about three low, tubercular gulars. Eyes small, hemispherical and their diameter corresponding to slightly less than half the length of gena. Antennae not reaching to tip of front legs and consisting of 26 joints; scapus about 2x longer than wide and tapering towards base, pedicellus cylindrical and less than half as long, III about as long as pedicellus and the following antennomeres first increasing and towards the tip of antennae decreasing in length; terminal antennomere much elongated and about as long as scapus.

Thorax. – Pronotum sub-trapeziform, somewhat wider than head; the triangular area faintly indicated by two converging rows of tubercles that gradually decrease in size towards the posterior; the anteriors represented by fairly prominent but obtuse bifid spines (Fig 9E). Transverse sulcus distinctly indented. Mesothorax 2.45x longer than prothorax and slightly gradually widening towards posterior. Mesonotum roughly rectangular and about 1.7x longer than wide; triangular area slightly surpassing middle of notum, length slightly more than width across anterolateral angles, the margins weakly convex and obtusely tubercular, the anterolateral angle rounded tuberculate; the interior surface concave (Fig. 9E). Posterior portion of mesonotum with a distinct granular medio-longitudinal keel that is faintly indicated in the triangular area; lateral margins unevenly granular. Mesopleurae slightly widening towards posterior with five very low, sub-obsolete tubercular laterals; the laterally migrated, conical mesopleural notably larger than laterals. Metanotum notably wider than long, trapezoidal in outline and with the same granular medio-longitudinal keel seen on mesonotum; the posterior with a pair of somewhat enlarged tuberculiform granules. Metapleurae with three small, sub-obsolete tubercular laterals and a fairly small tubercular metapleural; the supra-coxal angle moderately protruded and with a relatively small, conical supra-coxal. Mesosternum weakly carinate medio-longitudinally and destitute of mesosternals (Fig. 9F). Metasternum only with a faintly indicated medio-longitudinal carina.

Abdomen. – Segments I-VIII broadly transverse; median segment with anterior margin broadly rounded and weakly tectiform medio-longitudinally, following terga with a slight trace of a medio-longitudinal carina; II-V about 2.6 wider than long; V-X gradually narrowing; VII trapezoidal in dorsal aspect, only two-thirds the width of III-V. Terga II-IV with second paired posteriors merely represented by very low granular swellings. Sterna II-VII destitute of any noteworthy armature; praeopercular organ formed by a somewhat raised posterior margin in the median portion, that bears a small tubercular swelling at each lateral end. Tergum IX obtusely tectate and with a moderate, tubercular posteromedian swelling (Fig. 9G). Anal segment strongly declining with the lateral margins obliquely convergent in posterior half and with a fairly well developed medio-longitudinal carina; close to anterior margin with a closely spaced pair of nodes and posterior margin broadly rounded (Fig. 9H). Epiproct weakly tectate longitudinally with an indication of a medio-longitudinal carina, the lateral margins weakly and obliquely convergent and the posterior margin rounded with a small median protrusion. Subgenital plate fairly elongate, notably projecting beyond epiproct, navicular, distinctly carinate in posterior half and the apex narrowly triangular and acute (Fig. 9G-I).

Legs. – All slender and elongate with the teeth much reduced; all carinae of metatibiae only with about three obtusely dentiform swellings. Pro- and mesofemora somewhat shorter than mesothorax; metafemora reaching about halfway along abdominal segment V and metatibiae roughly reaching to tip of abdomen. Basitarsi about as long as following three tarsomeres taken together.

Measurements of holotype [mm]. – Body 39.7, pronotum 3.1, mesonotum 7.1, metanotum 3.0, median segment 1.9, profemora 7.3, mesofemora 5.7, metafemora 9.8, protibiae 7.6, mesotibiae 6.5, metatibiae 9.8, antennae 12.7.

Measurements of paratypes [mm]. – Body 38.0-43.0, pronotum 2.9-3.2, mesonotum 6.8-7.2, metanotum 2.9-3.1, median segment 1.8-1.9, profemora 6.8-7.4, mesofemora 5.6-5.8, metafemora 8.8-9.6, protibiae 7.2-7.5, mesotibiae 6.2-6.9, metatibiae 9.0-10.0, antennae 12.7-13.3.

♂ (Fig. 10)

Form and colouration. – Size small (body length 29.6-30.7 mm), general form fairly slender and elongate, the elements of armature essentially like in ♀ but comparatively more developed; the legs broader and stouter with the metafemora moderately incrassate and thickened towards the base. Colour like in ♀. The terminal twelve antennomeres ochraceous and lighter in colour than rest of antennae.

Head. – Like in ♀ but the anterior supra-orbital much longer and spinose (Fig. 10F) and the eyes proportionately somewhat larger with their diameter corresponding to only about 0.6x the length of gena. Antennae only with 24 segments with all joins proportionally shorter; almost reaching to tip of protarsi.

Thorax. – Pronotum essentially as in ♀ but less trapeziform in outline and the bifid anterior much longer, spinose with the anterior spine projecting over anterior margin of notum (Fig. 10F). Mesothorax 2.3x longer than prothorax and just slightly widening towards posterior. Mesonotum sub-trapezoidal with the lateral margins slightly converging towards the posterior and about 2.1x longer than width at anterior margin; the triangular area notably longer than in ♀ being about 0.7x the length of mesonotum and 1.6x longer than width across anterolateral angles; the lateral margins weakly concave and the anterolateral angles sub-spiniform (Fig. 10F); posterior portion with a distinct medio-longitudinal bulge that bears two parallel rows of granules, the bulge not notably continued in the concave interior region of the triangular area. Mesopleurae weakly widening towards the posterior with the mesopleural represented by a fairly prominent, slightly backward arched spine. Metanotum trapezoidal in outline, noticeably longer than wide and with the same medio-longitudinal bulge seen in back of mesonotum; a closely spaced pair of nodes pre-posteriorly. Metapleurae with three nodulose laterals and a weakly enlarged; the supra-coxal angle moderately protruded and with a fairly prominent supra-coxal spine, that is slightly smaller than the mesopleural. Mesosternum densely granular and obtusely tri-carinate, the lateral carinae more granular (Fig. 10G). Metasternum with a distinct medio-longitudinal keel and lateral carinae indicated by uneven granules.

Abdomen. – Median segment distinctly trapezoidal in outline with the anterior margin rounded and the anterolateral areas somewhat impressed. Segments II-VII almost uniform in length and width, II sub-trapeziform and III-VII sub-quadrate; the second paired posteriors merely represented by weakly enlarged nodes. An indicated medio-longitudinal carina only on sterna II-IV. Terga VIII and IX somewhat transverse and with an obtuse medio-longitudinal ridge, which on IX is posteriorly protruded into a fairly distinct conical swelling; the posterolateral angles of IX. Anal segment distinctly trapezoidal, somewhat declining towards the posterior, the lateral margins angular and the posterior margin concave with the outer angles obtusely protruded (Fig. 10H). Epiproct broadly transverse and weakly rounded (Fig. 10H). Vomer shorter than width at base, the basal portion

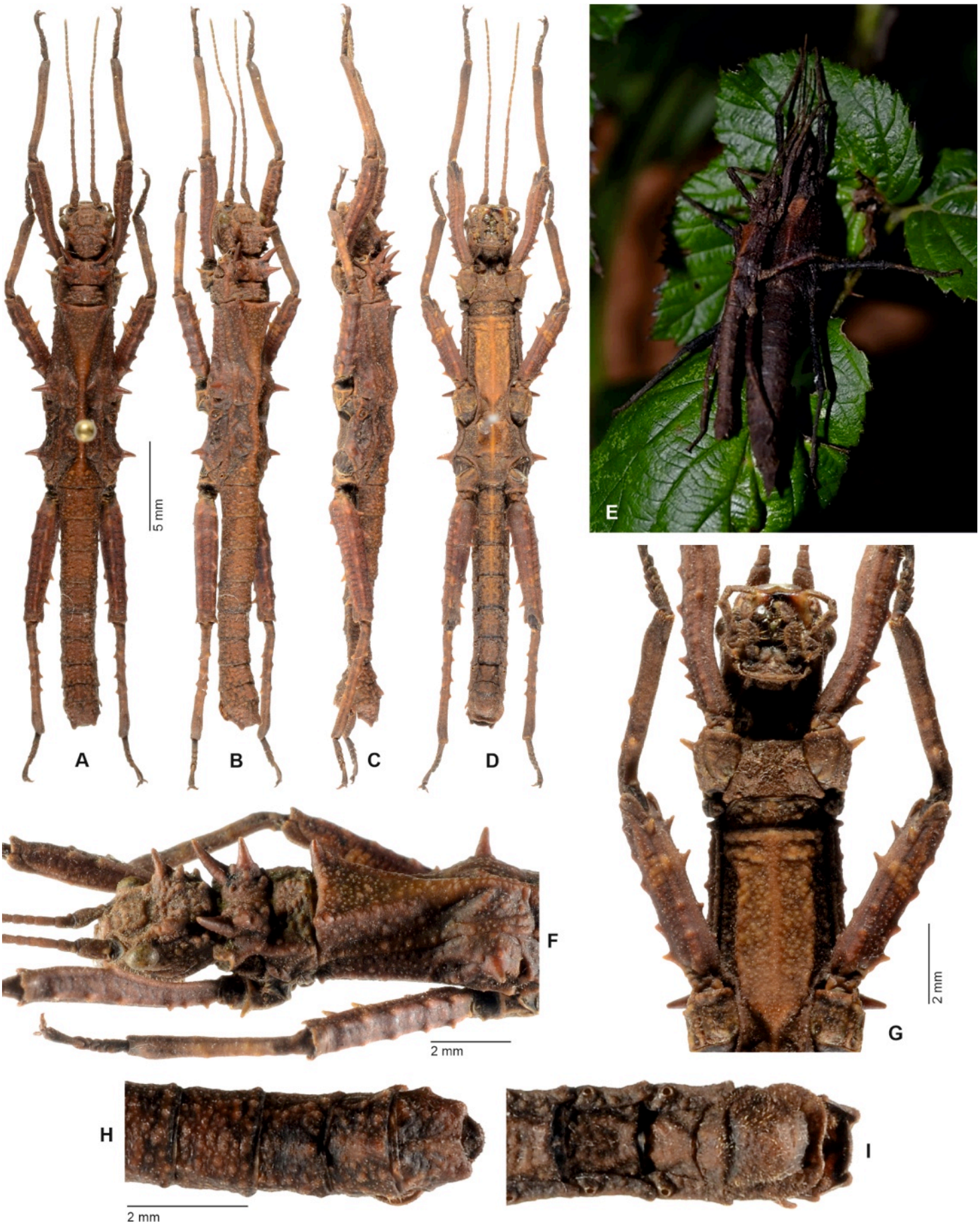

Fig. **10**. *Tisamenus charestae* **n**. **sp**. ♂ PT [FH 1355-8].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Live couple from Ifugao, Luzon (© Rob Krijns). **F**. Closeup of head, pro- and mesonotum. **G**. Closeup of pro-, meso- and metasternum. **H**. Terminalia in dorsal view. **I**. Terminalia in ventral view.

indented medially and the outer margin somewhat convex and inflated and the terminal hook short and somewhat displaced towards the right. Poculum rather shallowly cup-shaped with the posterior flange very broad, weakly bi-labiate and emarginate medially (Fig. 10I).

Legs. – All teeth comparatively more developed than in ♀. Pro- and mesofemora shorter than mesothorax, metafemora reaching about one-third the way along abdominal segment VI and metatibiae projecting beyond tip of abdomen by roughly the length of anal segment. Ventral teeth more spiniform than those on dorsal carinae. Ventro-basal portion of metafemora weakly gibbose and the two outer ventral carinae armed with 4-5 fairly distinct spiniform teeth; the ventral carinae of metatibiae each with about 3-4 obtuse teeth. Tarsi like in ♀.

Measurements of paratypes [mm]. – Body 29.6-30.7, pronotum 2.4-2.5, mesonotum 5.3-5.6, metanotum 2.7-2.8, median segment 1.7, profemora 5.6-5.8, mesofemora 4.8-5.0, metafemora 7.1-7.3, protibiae 5.6-5.9, mesotibiae 4.8-4.9, metatibiae 6.1-6.5, antennae 9.7-10.0.

Egg (Fig. 46E–F)

Small for the genus; capsule ovoid but widest about one-third below anterior margin, the dorsal surface just scarcely more convex than ventral surface and the polar-area with a shallow indention; slightly oval in cross-section, notably higher than wide and capsule 1.6x longer than wide. Surface densely but unevenly covered by node-like to tubercular protuberances; these notably fewer in number just below the weakly inflated and granular anterior margin. Micropylar plate small and only about 0.67x the length capsule; Y-shaped with the median portion large and rather broad but staying clearly away from anterior margin of the capsule and the two posterolateral extensions small, narrowing and directed about 35° off the axis of the egg capsule; the posterior portion narrowly V-shaped with a very small tubercular micropylar cup in centre. Outer margin of plate marked by a granular bulge; the surface essentially sculptured like capsule but with the protuberances distinctly fewer to almost wanting along the outer margin. Median line a distinct but shallow longitudinal bulge that slightly projects below the posterolateral extension of the plate. Operculum oval with the central portion notably raised but flat and with a shallow indention in centre; outer opercular collar and raised central portion unevenly but very densely covered with nodose to tubercular protuberances (only the lower outer portion and the centre with distinctly less sculpturing). Colour uniformly greyish mid brown, the outer margin of the micropylar plate and the micropylar cup dark brown. Measurements [mm]: Length incl. operculum 3.3, length 3.1, width 1.9, height 2.3, length of micropylar plate 2.1.

Remarks. – Breeding was attempted in Europe with eggs obtained from specimens collected at Ifugao by T. Heitzmann (Philippines) and Albert Kang (Singapore) in October 2013 but did not succeed.

Distribution. – Luzon, endemic. N-Luzon: Province Ifugao (Central Cordillera, Cambulo trail, 1750 m [IMQZ, RBINS, FH – type locality]); Province Ifugao [TB].

Tisamenus clotho (Rehn & Rehn, 1939)

(Fig. 11-13, 46G-H)

Hoploclonia clotho Rehn & Rehn, 1939: 473, pl. 34: 29 (♀).

HT, ♀: Polillo Taylor; *Hoploclonia clotho* Rehn & Rehn Type H. 1345; Data Base Serial No. Assigned as Type No. September 2008. Type # 9125 [ANSP];
PT, ♀: Polillo Taylor; *Hoploclonia clotho* Rehn & Rehn, Allotype Paratype; Allotype No. 53316 U.S.N.M. [USNM];
PT, ♀ (juveniles): Polillo Taylor; 16748; *Hoploclonia clotho* Rehn & Rehn, Paratype [USNM];
PT, **2** ♀ (juveniles): Polillo Taylor; 16748; *Hoploclonia clotho* Rehn & Rehn, Paratype [ANSP];
PT, ♂ (juvenile): Polillo Taylor;

Hoploclonia clotho Rehn & Rehn, Paratype [ANSP].

Tisamenus clotho, Zompro, 2004: 206.

- Otte & Brock, 2005: 334.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

= *Hoploclonia atropos* Rehn & Rehn, 1939: 475, pl. 35: 36 (♀).

HT, ♀: Philippine Ids. 1932; E H Hareford Coll;

Hoploclonia atropos Rehn & Rehn, Type; Type No. 53315 U.S.N.M. [USNM]. **n**. **syn**.

Tisamenus atropos, Zompro, 2004: 206.

- Otte & Brock, 2005: 334.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Material examined

6 ♀, **5** ♂, **13** eggs: ex Zucht F. Hennemann 2020, Herkunft: Philippinen. S-Luzon, Bicol Reg., Prov. Camarines Norte, Bagacay & Mananap [FH, No's 1039-1 to 11 & E];

1 ♂, **1** ♀ (penultimate instar): Philippinen, Zentral Luzon Id., Provinz Nueva Ecija, Gabaldon, local collector VIII.2012 [FH, No's 1029-12 & 13].

Differentiation. – This distinctive species is characteristic for combining a stocky shape and strongly widened meso- and metapleurae with a prominent head and body armature. Morphologically it is most similar to *T. hystrix* (Rehn & Rehn, 1939) and *T. lachesis* (Rehn & Rehn, 1939). From *hystrix*, which is an endemic of the island of Sibuyan and thus geographically separated, ♀ are distinguished by the slightly larger dimensions and heavier built with stockier and less elongate legs, the metatibiae of which do not reach the apex of the ovipositor (Fig. 11A-E). There is a prominent pair of posteriors on abdominal terga II-V (often also on VI-VII in *hystrix*) and a small posterior mesal on all abdominal terga and the pair of inter-posterior tubercles on the meso- and metanotum seen in *hystrix*, are missing in *clotho* (Fig. 11C, I). Males are easily separated from those of *hystrix* by the stockier body shape and limbs (Fig. 12A-D) and notably more incrassate metafemora (Fig. 12E), which possess a distinct ventro-basal swelling, the lack of inter-posterior meso- and metanotals and posteriors on abdominal terga V-VI (occasionally very small on V; Fig. 12C). From the notably larger *lachesis* both sexes of *clotho* are readily distinguishable by the much stockier overall shape and relatively shorter body segments, more widened meso- and metapleurae and longer pleural spines, as well as the wider mesonotal triangular area, which is about as long as it is wide across the anterolateral angles and roughly forms an isosceles triangle (distinctly longer than wide in *lachesis*). The eggs (Fig. 46G-H) may be distinguished from those of *lachesis* by the bulgier shape, lighter greyish colour, much less developed fringy carinae and hairy structures of the capsule, fairly wide anterior constriction just below the anterior margin of the capsule and notably longer posterolateral extensions of the micropylar plate. From the eggs of *hystrix* they can be distinguished by the broadly constricted anterior margin and slightly less developed sculpturing of the capsule as well as the somewhat longer posterolateral extensions of the micropylar plate.

Description

♂ (Fig. 12)

Form and colouration. – Size average for the genus (body length 37.0-42.5 mm); general form rather stocky, legs fairly strong and slightly incrassate; elements of armature rather prominent with strong meso- and metapleural spines. General colour mid brown with most spines tipped with grey (Fig. 13C), the meso- and metasternum tawny and the femora with faint tawny markings ventrally (Fig. 12D). Antennae drab with the terminal twelve joints buff.

Head. – Sub-quadrate, scarcely longer than wide with the genae roughly parallel-sided. The three supra-orbitals moderately prominent, conical with the median one largest (Fig. 12J); occipitals and median coronals rather small, and much lower than orbitals, the lateral coronals tuberculate, weakly bifid and somewhat larger than occipitals. Eyes fairly large, hemispherical and their diameter corresponding to about 0.6x length of gena. Genae supplied with 2-3 low, tuberculate gulars. Antennae strong, perlamorph with all joints fairly short and consisting of 24 joints (Fig. 12J); scapus triangular in dorsal aspect,

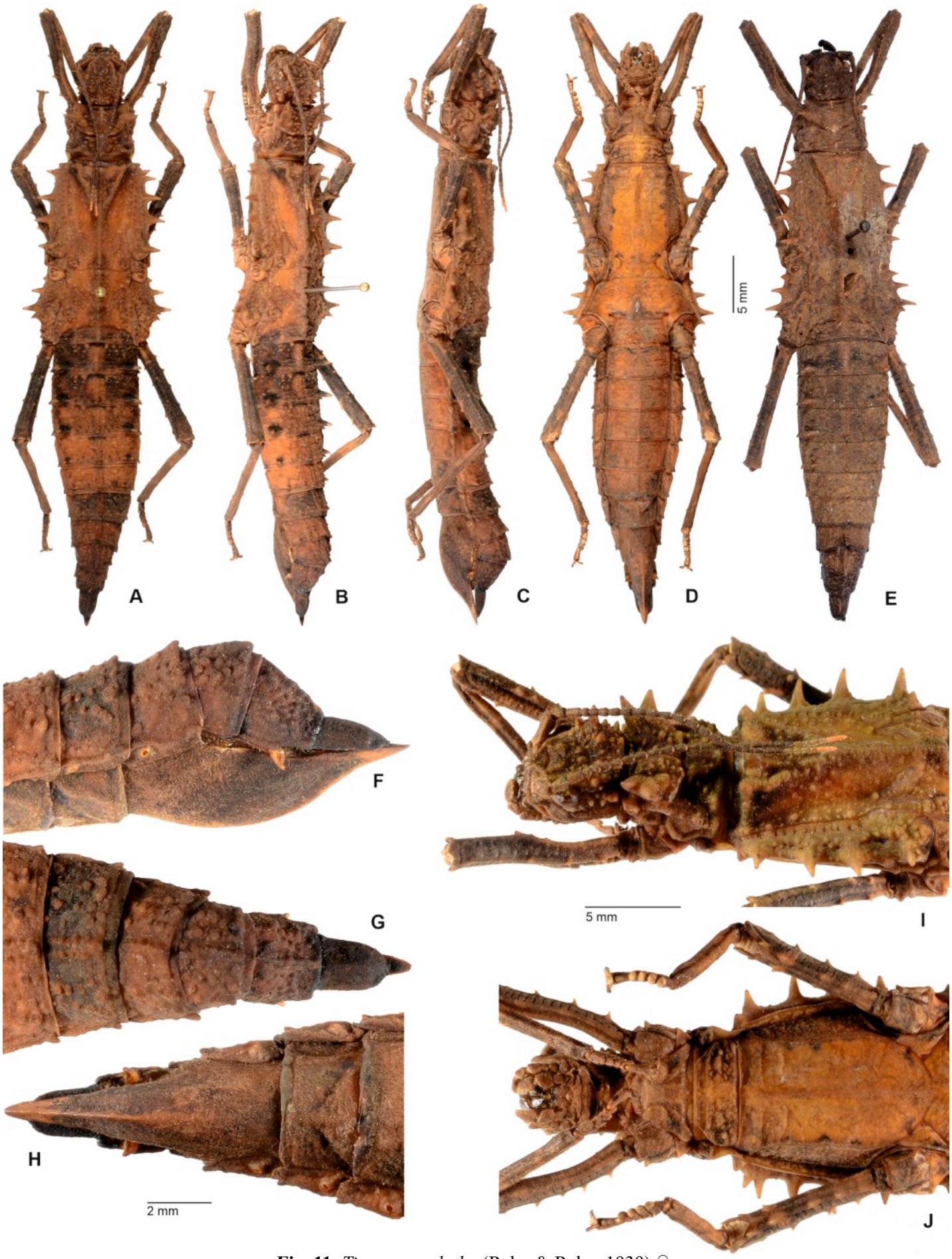

Fig. **11**. *Tisamenus clotho* (Rehn & Rehn, 1939) ♀.

A. Dorsal view [FH 1039-6]. **B**. Dorsolateral view [FH 1039-6]. **C**. Lateral view [FH 1039-6]. **D**. Ventral view [FH 1039-6]. **E**. Holotype, dorsal view [ANSP]. **F**. Terminalia in lateral view [FH 1039-6]. **G**. Terminalia in dorsal view [FH 1039-6]. **H**. Terminalia in ventral view [FH 1039-6]. **I**. Closeup of head, pro- and mesonotum [FH 1039-6]. **J**. Closeup of pro-, meso- and metasternum [FH 1039-6].

Fig. **12**. *Tisamenus clotho* (Rehn & Rehn, 1939) ♂ [FH 1039-8].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Anteroventral view of left hind leg. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I**. Closeup of head, pro- and mesonotum [FH 1039-6]. **J**. Closeup of pro-, meso- and metasternum.

pedicellus about half the length of scapus and almost cylindrical; III slightly longer than pedicellus, IV much shorter and up to XII slightly increasing in length, then very weakly decreasing with the terminal antennomere much elongated and slightly longer than preceding two joints combined.

Thorax. – Pronotum sub-quadrate; triangular area just weakly indicated with margins behind the transverse median sulcus bounded by sub-obsolete granules and anterolaterally with a strong bifid spine, whose second spike is somewhat longer than the anterior one (Fig. 12C, J). Mesothorax broad, widening towards the posterior but with outer margins of mesopleurae gently convex in outline (Fig. 12A); about 2.2x longer than prothorax and with posterior portion 1.6x wider than anterior margin. Mesonotum sub-trapeziform with lateral margins very slightly convergent towards the posterior and with a narrowing post-medially, about 2.2x longer than width at anterior margin; the triangular area almost attaining middle of notum, about as long than wide, disk shallowly concave and the margins shallowly granulate with the anterolateral angles protruded into an obtusely rounded tubercle (Fig. 12J); posterior portion of mesonotum with a broad and shallowly granulate medio-longitudinal bulge, that is faintly indicated in the triangular area; the posterior portion of the bulge weakly raised and rounded (Fig. 12C, J). Mesopleurae notably expanding towards the posterior and convex in outline with four laterals, the antero-lateral small and sub-obsolete, the second notably larger and the third and fourth prominent, spinose; mesopleural a prominent conical spine. Metanotum trapezoidal with a post-anterior narrowing, a little longer than wide and with the same granulose medio-longitudinal keel seen on mesonotum; which is somewhat gibbose posteriorly if seen sideways. Metapleurae with two laterals, the anterior one of which is small and sub-obsolete and the second strong and tubercular; metapleural small, tubercular

Fig. **13**. *Tisamenus clotho* (Rehn & Rehn, 1939) Live insects.

A. ♀ near Mount Isarog, Camarines Sur, South Luzon [© Albert Kang https://inaturalist.ca/observations/57639420]. **B**. Captive reared ♀ from Camarines Norte Province, South Luzon. **C**. Captive reared ♂ from Camarines Norte Province, South Luzon.

and the supra-coxal angle with a strong supra-coxal spine. Mesosternum distinctly tri-carinate with the lateral carinae supplied with three shallow node-like mesosternals; anteriorly the lateral carinae are connected by a distinct, straight transverse carina Fig. 12I); metasternum with a shallow medio-longitudinal carina and a few faint indications of metasternals laterally.

Abdomen. – Median segment transverse with anterior margin broadly rounded, shallowly carinate medio-longitudinally and with a very small nodose pair of second paired posteriors. Segments II-VI very slightly decreasing in width and somewhat sub-uniform in length with III-V roughly quadrate but II and VII weakly transverse and II trapezoidal in outline; terga II and III with low tuberculate paired second posteriors (just represented as small nodes on IV). Terga II-VII with very faintly indicated medio-longitudinal carina, which is more pronounced but rather obtuse on VIII and IX and posteriorly terminates in a low node on these two terga. Sterna II-VII with a fine medio-longitudinal carina (Fig. 12D). Anal segment longer than IX, somewhat cucullate in lateral aspect (Fig. 12F), narrowed posteriorly with the lateral margins shallowly angular and the dorsal surface with an obtuse and low medio-longitudinal bulge; posterior margin with a broad and very shallow, concave median excavation and the outer angles protruded and shortly digitiform (Fig. 12G). Epiproct distinct, shield-shaped and almost semi-circular in shape and notably projecting beyond anal segment (Fig. 12G). Vomer very broad, distinctly transverse with a short but strong, upcurved terminal hook. Poculum rounded, cucullate with a large and very broad, weakly labiate posterior flange (Fig. 12H), that is slightly down-curved and reaches more than halfway along anal segment (Fig. 12F).

Legs. – All stocky with the femora somewhat incrassate; the femoral teeth however comparatively small. Pro- and mesofemora somewhat shorter than mesothorax, metafemora reaching halfway along abdominal segment V and metatibiae roughly reaching to tip of abdomen. Ventro-basal swelling of metafemora distinct, sub-globose and supplied with two small, rounded tubercles (Fig. 12E); the four teeth of dorsal carinae increasing in size towards base of femur with the two basal teeth prominent and somewhat spiniform. Metatibiae smooth dorsally and with 5-10 small, blunt teeth-like swellings ventrally (Fig. 12E). Basitarsi short and just slightly longer than following two tarsomeres taken together.

Measurements [mm]. – Body 37.0-42.5, pronotum 3.2-3.6, mesonotum 7.0-7.7, metanotum 3.1-3.9, median segment 2.0-2.3, profemora 7.0-7.3, mesofemora 5.1-5.4, metafemora 7.7-8.1, protibiae 6.8-7.0, mesotibiae 5.7-6.1, metatibiae 8.1-8.6, antennae 12.5-13.5.

Egg (Fig. 46G-H)

Large for the genus; capsule oval with the anterior portion possessing a distinct constriction just below anterior margin and the dorsal surface slightly bulgier than ventral surface; oval in cross-section and notably higher than wide; the capsule 1.6x longer than wide. Surface very minutely but densely granular and with a rather shallow, uneven and not fully contiguous meshwork of fine ridges; these most pronounced antero-dorsally and at polar-area where these ridges are partly covered by short, fringy to setose structures. Micropylar plate fairly large and almost 0.8x the length capsule; broadly Y-shaped with the median portion large but not reaching anterior margin of capsule and the two posterolateral extensions moderately sized, somewhat narrowed apically and directed about 40° off the axis of the egg capsule; the posterior portion rather narrowly V-shaped with a small bowl-shaped micropylar cup in centre. Outer margin of plate marked by an unevenly granular but rather narrow bulge; the interior surface notably inflated and densely bur unevenly rugulose to tubercular; a rather broad rim between the outer margin and raised inner portion somewhat indented and lacking and protrusions. Median line marked by a shallow and rather short fringy bulge that scarcely extends to the lower margin of the posterolateral extensions of the micropylar plate. Operculum oval and just very weakly convex in centre; surface with several irregular radially directed carinae and rugulae the interiorly merge to form an uneven raised rim of rugulae; outer margin somewhat inflated and granular. Colour uniformly mid grey with the fringy appendages of the capsule yellowish ochre; outer margin of micropylar plate brown. Measurements [mm]: Length incl. operculum 4.2, length 4.1, width 2.5, height 3.0, length of micropylar plate 3.2.

Variability. – Slight variability is seen in the size of the cephalic, thoracic and abdominal armature, the holotype of *H. atropos* Rehn & Rehn, 1939, for example, having all the spines, but the pronotal anteriors and second paired posteriors of the basal abdominal terga in particular notably less developed than in all the other specimens at hand. Noteworthy variability is seen in the mesopleural laterals of ♀, which vary in that the two anterior spines range from very small and sub-obsolete to tubercular and occasionally some ♀ possess an additional small spinose lateral in the anterior portion making a total of five instead of the usual four laterals (e. g. sample coll. FH, No. 1039-5). Body length of ♀ 49.0-57.0 mm.

Remarks. – Rehn & Rehn (1939: 473) described *Hoploclonia clotho* from a series of ♀ examples from the island of Polillo. Examination of the ♀ from an unspecified locality and representing the holotype of *H. atropos* Rehn & Rehn, 1939 in the collection of USNM and comparison with *clotho* leaves no doubt it is a specimen with slightly less pronounced elements of armature of the same species. Thus, *atropos* is here synonymised under *clotho* because the latter species has page preference (**n**. **syn**.). The only two characters that Rehn & Rehn consulted to separate *atropos* from *clotho* are the straight instead of arcuate converging carinae of the mesonotal triangular area and slightly shorter and proportionally heavier legs. Both characters however lie within the range of intraspecific variability as can be seen by the examination of more comprehensive material now available for examination (see above). Moreover, other species in the genus like *T. lachesis* (Rehn & Rehn, 1939) have shown Polillo not necessarily to harbour endemic species but several species to be also found on Luzon. The ♂ and egg are here formally described for the first time and illustrated.
Specimens were found in the Camarines Norte province by Thierry Heitzmann (Philippines) on two occasions and at two different localities in 2015, this is Mount Bagacay and Mananap Falls. Eggs were sent to Europe for breeding purposes and a culture could be established, which has however not been given a culture number by the Phasmid Study Group. It was identified by Joachim Bresseel (RBINS) and was first distributed as *Tisamenus* cf. *clotho* 'Camarines' and later as *T. clotho*.

Distribution. – Polillo Island [ANSP, USNM – type locality]. S-Luzon. Bicol Region: Province Camarines Norte (Mananap Falls [FH]; Bagacay [FH]); Province Camarines Sur (Bula [photographic record by Albert Kang: https://inaturalist.ca/observations/57639420]. C-Luzon: Province Nueva Ecija (Gabaldon [FH])

Tisamenus deplanatus (Westwood, 1848)
(Fig. 14-16, 46I-J)

Phasma (Pachymorpha) deplanatum Westwood, 1848: 78, pl. 38: 6 (♀).
HT, ♀: Phil. Isla., 42 22; *Phasma (Pachymorpha) deplanatum* Westw. Orient. Ent. t 38 f 6; Holotype; BMNH(E) #845220 [NHMUK].

Acanthoderus deplanatus, Westwood, 1859: 52.

Tisamenus deplanatus, Stål, 1875: 93.
- Kirby, 1904: 399.
- Redtenbacher, 1906: 44.
- Bruner, 1915: 229.
- Harman, 2022: 24.
- Brock & Büscher, 2022: 521, fig.
- Hennemann, 2023b: 128.

Tisamenus deplanata, Zompro, 2004: 206.
- Otte & Brock, 2005: 334.
- Brock *et al.,* 2016: 168. (Type data)

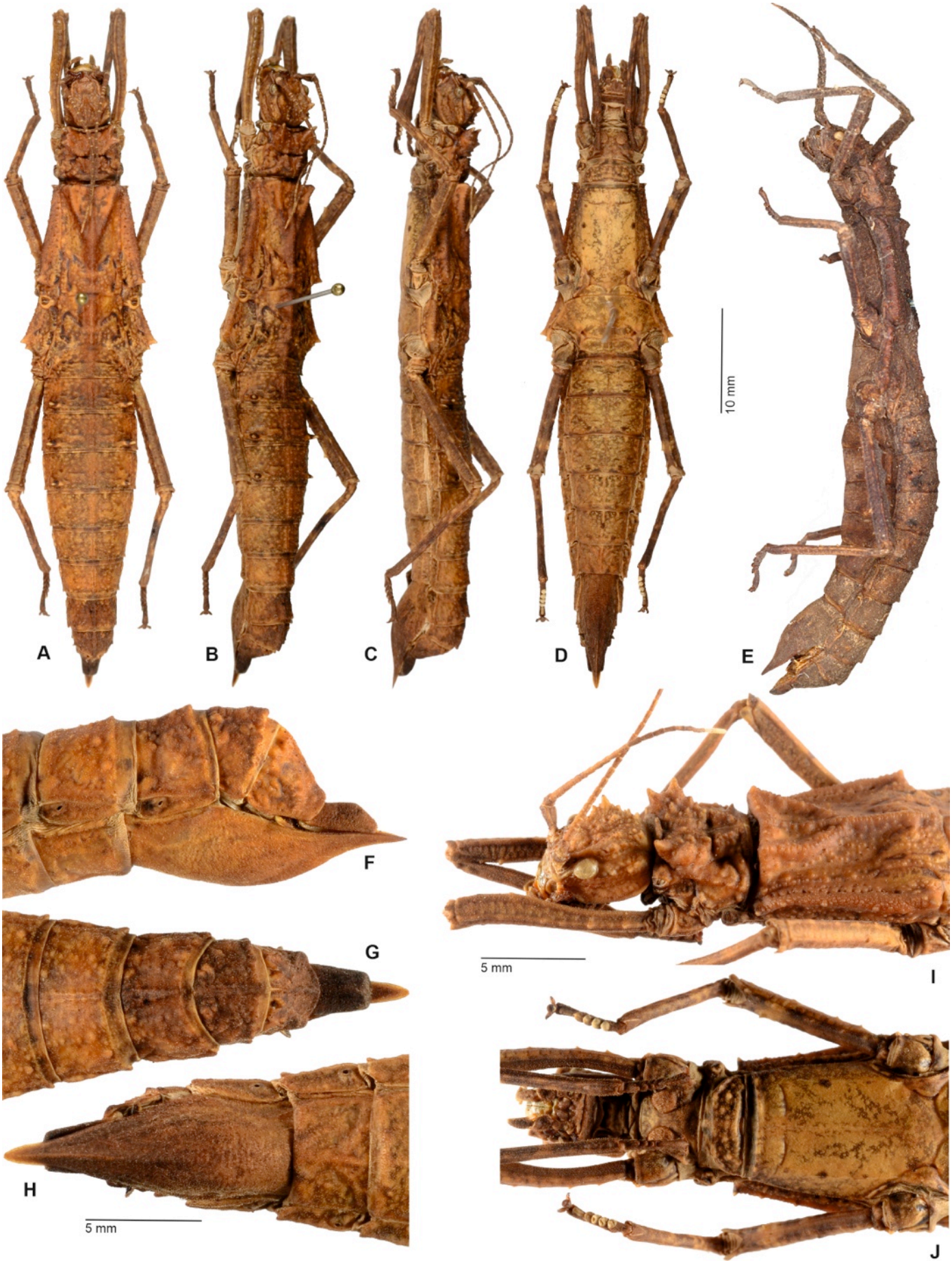

Fig. **14**. *Tisamenus deplanatus* (Westwood, 1848) ♀.

A. Dorsal view [FH 0904-6]. **B**. Dorsolateral view [FH 0904-6]. **C**. Lateral view [FH 0904-6]. **D**. Ventral view [FH 0904-6]. **E**. Holotype, lateral view [NHMUK © Paul D. Brock]. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I:** Closeup of head, pro- and mesonotum [FH 0904-6]. **J**. Closeup of pro-, meso- and metasternum [FH 0904-6].

Tisamenus armadillo, Zompro, 2004: 206, figs. 117a-b (in part – only the illustrated specimens from Ilocos, Luzon).

[**Not**: *Hoploclonia deplanata*, Rehn & Rehn, 1939: 477, pl. 35: 34 (♀). (*Deplanata* Group). Misidentification relating to *T. cervicornis* Bolívar, 1890]

[**Not**: *Tisamenus deplanata*, Dräger, 2012: 14, figs. 23-25. Misidentification relating to *T. cervicornis* Bolívar, 1890]

Material examined

2 ♀, **1** ♂: Coll. R.I.Sc.N.B., Philippines, N-Luzon, Ilocos, III.2014, leg. T. Heitzmann [RBINS];

2 ♀, **2** ♂: Coll. R.I.Sc.N.B., Philippines, Luzon, Ilocos, ex breeding Sven Bradler 2019, Phasmid Study Group #391 [RBINS];

1 ♂: Coll. R.I.Sc.N.B., Philippines, N-Luzon, Ilocos [RBINS];

1 ♀, **1** ♂: Luzon, Ilocos N., Burgos, coll. W. Schultze [SMTD];

18 ♀, **10** ♂, eggs: ex Zucht F. Hennemann 2016-2017, Herkunft: Philippinen, N-Luzon, Prov., Ilocos Norte, leg. T. Heitzmann 2014 [FH, No's 0904-1 to 28, E].

Differentiation. – This species is morphologically closest to *T. cervicornis* Bolívar, 1890 and *T. asper* Bolívar, 1890. From *cervicornis* both sexes can readily be separated by the notably larger mesonotal triangular area (Fig. 14I, 15I), which attains the middle of the mesonotum and is longer than it is wide across the anterolateral angles. Males are also easily distinguished by having the meso- and metanotum gibbous and bi-nodose pre-posteriorly (Fig. 15C) and the terminal hook of the vomer backward-directed (arched towards the left in *cervicornis*) and ♀ are distinguished by the characteristically convex and gibbous epiproct (Fig. 14F). Moreover, both sexes are on average larger and slightly less stocky in shape than *cervicornis*. The more rounded and bulgy eggs (Fig. 46I-J) are well differentiated from those of *cervicornis* by having the capsule surface much less sculptured and only covered with a faintly raised network of ridges, and the micropylar plate being almost as long as the capsule with the anterior extension noticeably longer than the posterolateral extensions. With *asper* this species shares the fairly large mesonotal triangular area that is longer than wide across the anterolateral angles and slightly surpasses the middle of the mesonotum, but in *deplanatus* the carinae are much more pronounced and triangularly protruded anteriorly. Moreover, both sexes of this species are stockier in shape, lack the four mesopleural laterals seen in *asper* (six tuberculate mesopleurals in total in *asper*) and have prominent bi-spinose anterior pronotals (Fig. 14I, 15I) as well as distinct second paired posterior spines on abdominal terga II-III (or II-IV), both elements of which are poorly developed and obtuse in *asper*.

Description

♂ (Fig. 15)

Form and colouration. – Size average for the genus (body length 38.3-43.0 mm); general form relatively slender, legs fairly strong with only the metafemora incrassate; elements of armature rather weakly developed. Mesothorax strongly widening towards posterior, meso- and metanotum with a distinct, bi-tuberculate, gibbose posteromedian swelling and body surface minutely and unevenly granular and nodose. General colour dark buff to brown, the meso- and metasternum tawny and the meso- and metafemora with a sub-apical tawny transverse band ventrally (Fig. 15D). Antennae orangey brown with only the terminal joint ochre.

Head. – Sub-quadrate, a little longer than wide with the genae roughly parallel-sided. The four supra-orbitals moderately prominent, conical with the second one largest (occasionally compound); occipitals and coronals rather low, rounded tuberculate (Fig. 15I). Gulars small and nodose. Eyes of average size, moderately globose and their diameter corresponding to scarcely less than half the length of gena. Antennae consisting of 27 joints (Fig. 15I); scapus triangular in dorsal aspect, pedicellus about half as long as scapus, round in cross-section and somewhat narrowing towards apex; III about as long as pedicellus, IV only one-quarter the length of III, following joints up to about XVIII very slightly increasing in length, then decreasing with the terminal antennomere notably elongated and almost as long as three preceding joints taken together.

Thorax. – Pronotum sub-trapeziform; triangular area fairly distinct with margins minutely tubercular and the anterolateral angles with a strong and prominent, conical bifid tubercle (Fig. 15I); transverse median sulcus distinctly indented and almost straight. Mesothorax distinctly widening towards posterior, about 2x longer than prothorax and with posterior portion 1.45x wider than anterior margin. Mesonotum elongate with lateral margins weakly convergent towards the posterior and with a distinct concave post-medial constriction; about 2.1x longer than width at anterior margin and with a gibbose posteromedian swelling that bears a pair of low, closely spaced inter-posterior tubercles (Fig. 15C); the triangular area rather large, somewhat surpassing middle of notum, notably longer than wide, disk shallowly concave and the straight, converging outer margins densely granular and anteriorly protruded into a fairly prominent, conical, somewhat posterior directed tubercle; posterior portion of mesonotum with a minutely but densely granulose medio-longitudinal bulge, that is clearly visible in the posterior half of triangular area (Fig. 15I). Mesopleurae strongly expanding towards the posterior with the five laterals merely represented by low rounded nodes; mesopleural a rather small and simple conical tubercle. Metanotum distinctly trapezoidal in outline, a little longer than wide and with the same granulose medio-longitudinal bulge and bi-tuberculate, gibbose posterior swelling seen on mesonotum. Metapleurae with laterals sub-obsolete, the metapleural somewhat more pronounced and the supra-coxal angle with a strong but short supra-coxal tubercle that is accompanied by a much smaller tubercle posteriorly. Mesosternum distinctly tri-carinate with the lateral carinae arched and converging in posterior portion (Fig. 15J); metasternum only with a rather shallow medio-longitudinal carina.

Abdomen. – Median segment almost semi-circular in outline, carinate medio-longitudinally and with a small node-like pair of first and second paired posteriors. Segments II-VII slightly sub-uniform in length and width, II-VI very gently narrowing and V-VII slightly decreasing in length; II sub-trapeziform, IV roughly quadrate and VI-VII slightly transverse. Terga II-VII all with a shallow medio-longitudinal carina that is indicated by two parallel rows of slightly pronounced granules; II-IV with paired second posteriors, that are spinose on II, tubercular on III and merely nodose on IV. The medio-longitudinal carina posteriorly terminating in a tubercular swelling that is most prominent on IX. Sterna II-VII with a fine medio-longitudinal carina (Fig. 15D). Anal segment moderately declining and somewhat narrowing towards the posteriorly with the lateral margins angular and the dorsal surface with an obtuse medio-longitudinal carina; posterior margin with a wide, roundly angular median emargination and the outer angles obtusely triangularly protruded (Fig. 15G). Epiproct transverse, roundly trapeziform with a shallow posteromedian indention and slightly projecting beyond posterolateral protrusions of anal segment (Fig. 15G). Vomer broadly heart-shaped with the short but strong and up-curved terminal hook distinctly arched towards the left. Poculum angularly cup-shaped with a very broad and labiate posterior flange of the free upper margin, that is distinctly down-curved (Fig. 15F) and shallowly emarginated posteriorly (Fig. 15H) and reaches about halfway along anal segment.

Legs. – Moderately stocky with the femoral teeth fairly distinct and acutely triangular; the dorsal ones of the metafemora decreasing in size towards apex of femur and the three terminal teeth on ventral carinae strong, spinose and roughly uniform in size. Pro- and mesofemora noticeably shorter than mesothorax, metafemora reaching one-third along abdominal segment V and metatibiae roughly reaching to tip of abdomen. Pro- and mesofemora with only the two apical teeth of outer ventral carinae distinct; these teeth also quite pronounced on metafemora, which have the four dorsal teeth small and somewhat increasing in size towards the base of femur. Ventro-basal swelling of metafemora distinct, sub-globose and smooth (Fig. 15E). Metatibiae smooth dorsally and with 5-6 small obtusely triangular teeth on two outer ventral carinae (Fig. 15E). Basitarsi short and just slightly longer than following two tarsomeres taken together.

Measurements [mm]. – Body 38.3–43.0, pronotum 3.8-4.0, mesonotum 7.2-7.5, metanotum 3.8-4.4, median segment 2.1-2.5, profemora 7.7-7.9, mesofemora 6.3-6.5, metafemora 8.9-9.9, protibiae 7.0-8.1, mesotibiae 6.2-6.9, metatibiae 8.0-9.0, antennae 12.0–13.0.

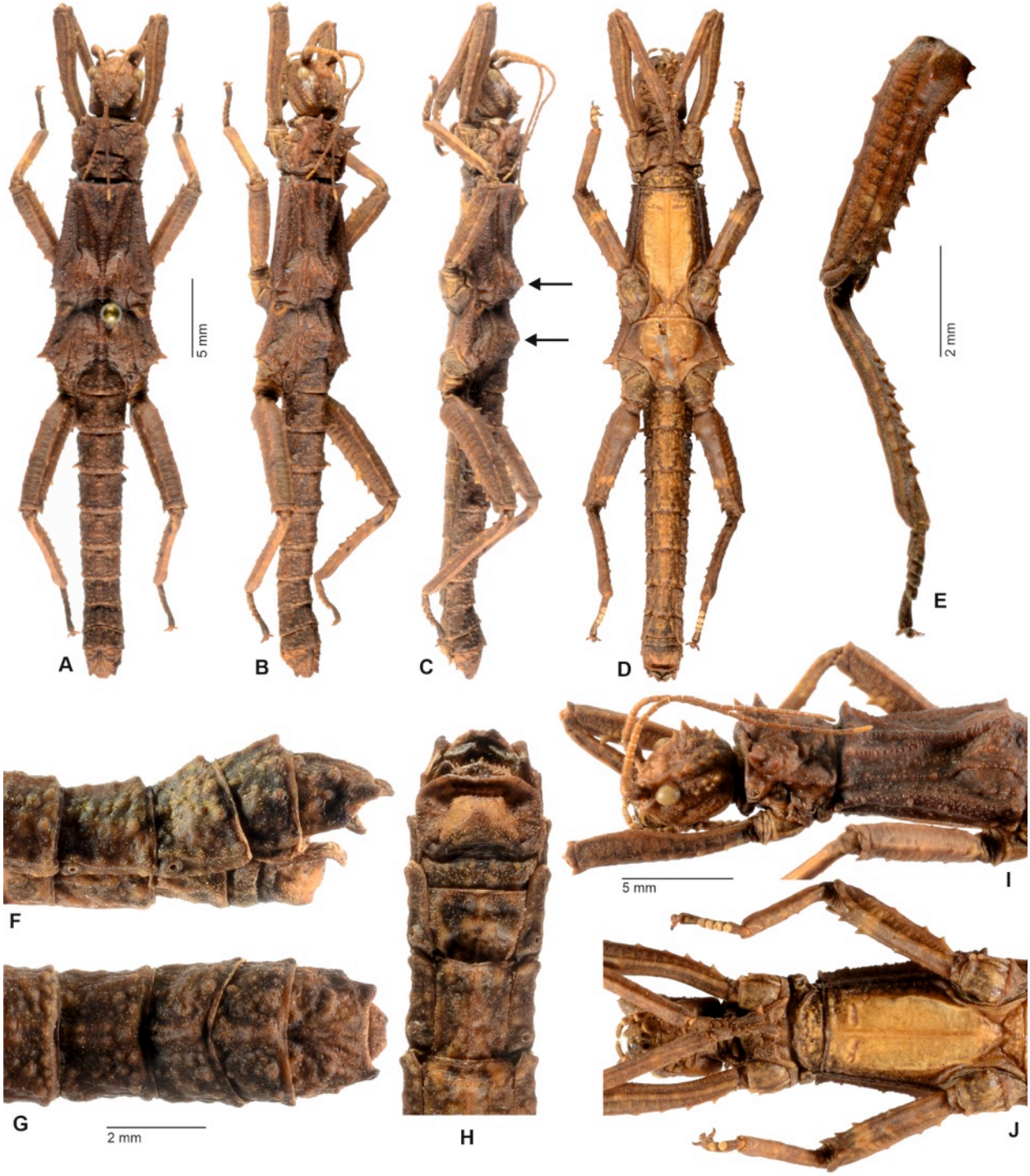

Fig. **15**. *Tisamenus deplanatus* (Westwood, 1848) ♂ [FH 0904-19].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view (arrows highlighting the gibbous and bi-nodose posteromedian swelling of the meso- and metanotum, which readily distinguishes *T. deplanatus* from the morphologically closest species). **D**. Ventral view. **E**. Anteroventral view of right hind leg. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I:** Closeup of head, pro- and mesonotum. **J**. Closeup of pro-, meso- and metasternum.

Variability. – The range of morphological variability among the fairly numerous examples at hand for examination is small and noteworthy variation is only seen in the size of the cephalic, thoracic and abdominal elements of armature and relative size of the mesonotal triangular area. Some examples of both sexes show a small interjacent point between the two spikes of the basically bifid pronotal anteriors, which may however only be present on one side. Body length of ♀ 56.0-67.0 mm.

Egg (Fig. 46I-J)

Fairly large for the genus; capsule roundly oval with a broad constriction of the anterior portion, the dorsal surface strongly bulgy and much more convex than the ventral surface, which is only somewhat bulgier in the lower portion; oval in cross-section and notably higher than wide; the capsule almost 1.6x longer than wide. Surface very minutely and densely granular and with a rather uneven and coarsely meshed network of granular ridges, which are most distinctly protruded and occasionally tuberculiform at their junctures. Micropylar plate very large and almost as long as capsule; narrowly Y-shaped with the median portion fairly uniform in width and approaching the anterior margin of capsule and the two posterolateral extensions slightly narrower and on lateral surfaces of capsule roughly reaching to axis of egg; the posterior portion 80° V-shaped with a small bowl-shaped micropylar cup in centre. Outer margin of plate notably inflated and granular, the interior portion distinctly raised and unevenly rugulose and the rim in between indented and destitute of any protrusions or

Fig. **16**. *Tisamenus deplanatus* (Westwood, 1848) Live captive reared insects from Ilocos Norte, North Luzon. **A**. Couple. **B**. ♀. **C**. ♂.

notable sculpturing. Median line almost indiscernible and only marked by a short and shallow carina. Operculum almost circular with an obtusely inflated outer collar; the interior portion somewhat convex, unevenly tubercular and with a distinct impression in centre. Colour mostly buff with the constricted anterior portion of the capsule greyish brown; micropylar cup dark brown. Measurements [mm]: Length incl. operculum 3.8, length 3.8, width 2.4, height 2.8, length of micropylar plate 3.2.

Remarks. – Originally described upon a unique ♀ holotype in the collection of NHMUK by Westwood (1848: 78), there was only one further record of *deplanata* in the literature. This record from Surigao, N-Mindanao by Rehn & Rehn (1939: 477) is based on a misidentified (see remarks on *T. cervicornis* Bolívar, 1890).
Culture stock of this species has originally been collected in March 2014 by Thierry Heitzmann (Philippines) in Ilocos Norte and eggs have been sent to Europe for breeding purposes. The culture maintained since has been given culture No. 391 by the Phasmid Study Group and was distributed as *Tisamenus* sp. 'Ilocos' or erroneously as *Tisamenus fratercula* 'Ilocos'. The true identity of the stock of PSG 391 is here clarified. The latter species is here synonymised under *T. cervicornis* Bolívar, 1890 (**n**. **syn**.). This species as well has proven pretty easy to breed in captivity.
The ♂ and egg are here formally described for the first time and illustrated.

Distribution. – Philippines [NHMUK – type locality]. N-Luzon: Province Ilocos Norte [RBINS, FH]; Ilocos Norte, Pagudpod [photographic records by Albert Kang: https://inaturalist.ca/observations/57634024, https://inaturalist.ca/observations/57610502]; Ilocos Region [SMTD].

Tisamenus draconinus (Westwood, 1848)

(Fig. 17-19, 46K-L)

Phasma (Pachymorpha) draconinum Westwood, 1848: 78, pl. 38: 5 (♀).

LT, ♀: Philippine islands, 42-22 (Purch. Mr. Cuming); Co-Type Westwood, *Phasma (Pachymorpha) draconinum*; Type Orth: 493, *Phasma (Pachymorpha) draconinum* Westw. [UMO, No. 493];

PLT, ♂: Co-Type Westw.; Philippine islands, 42-22 (Purch. Mr. Cuming);

Phasma Acanthoderus draconinus Westw.; Type Orth: 493, *Phasma (Pachymorpha) draconinum* Westw. [UMO, No. 493].

Acanthoderus draconinus, Westwood, 1859: 52.

Hoploclonia draconina, Stål, 1875: 93.
- Redtenbacher, 1906: 45.
- Rehn & Rehn, 1939: 468. (*Draconinus* Group)
- Cai, 1987: 26.

Tisamenus draconina, Bruner, 1915: 230.
- Zompro, 2004: 206.
- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Tisamenus draconinus, Kirby, 1904: 399.

Hoploclonia draconia, Bragg, 1995: 27. (Lectotype designation - Misspelling of *draconinus*).

[**Not**: *Hoploclonia draconina*, Matsumura & Hirayama, 1932: fig. Misidentification relating to *T. napalaki* **n**. **sp**.]

[**Not:** *Hoploclonia draconina*, Shiraki, 1935: 24 (Remark: Identification doubtful). Misidentification relating to *T. napalaki* **n**. **sp**.]

[**Not:** *Hoploclonia draconina*, Chen & He, 2008: 360, pl. 4: 4. Misidentification relating to *T. napalaki* **n**. **sp**.]

[**Not:** *Hoploclonia draconia*, Huang, 2002: 84, figs (Misspelling of *draconinus*). Misidentification relating to *T. napalaki* **n**. **sp**.]

[**Not:** *Hoploclonia draconia*, Xu, 2005: 335 (Misspelling of *draconinus*). Misidentification relating to *T. napalaki* **n**. **sp**.]

Material examined

1 ♀, **1** ♂: Philippinen, Ost Luzon Island, Provinz Aurora, Sierra Madre, Dingalan, 230 m, local collector, IV.2012 [FH 1104-1 & 2];

1 ♀, **2** ♂, **1** egg: Philippinen, O Luzon Id., Prov. Isabela, Sierra Madre, Cagayan Valley, Palanan, local collector II.2011 [FH, No's 1104-3 to 5, E1];

1 ♀, **1** egg: Philippinen, Polillo Island, local collector III.2011 [FH, No. 1104-6, E2];

2 ♂ (immature): Coll. R.I.Sc.N.B., Philippines, E Luzon, Isabela, San Pablo, IX.2014, local collector, I. Lumawig [RBINS];

1 ♀, **2** ♂: Coll. R.I.Sc.N.B., Philippines, Luzon, Cagayan, leg. T. Heitzmann [RBINS];

18 ♀, **23** ♂, **12** egg (ex ovipositor): ex Zucht F. Hennemann 2024, Herkunft: Philippinen, N-Luzon, Prov. Cagayan, Peñablanca Munip., nr. Callao Cave [FH, No's 1104-7 to 47 & E3];

5 ♂, **1** ♀, **2** ♀ (immature): Ripang, Apayo, Luzon Island, P.I.; W. Boettcher Feb. 1918 [ANSP];

1 ♂: Philippinen, Eastern Visayas, Prov. Leyte, Leyte Island, Mahaplag Munip., local collector VI.2012 [FH, No. 1104-48].

Differentiation. – This new species shows the closest affinity to *T. napalaki* **n**. **sp**. with which it shares the four large mesopleural spines. It is however distinguishable by the notably smaller dimensions and slightly stockier shape of both sexes and generally having the body armature less pronounced with all the major spines comparatively shorter and stouter and having only one metapleural lateral instead of two like in *napalaki* (Fig. 17A, 19A). Males may also be distinguished from those of *napalaki* by the more evident mesothoracic constriction at the 3rd mesopleural lateral, lack of the characteristic gibbous dorsal swelling of abdominal terga II-V and much smaller pair of posteriors on terga II-III as well as the more distinct ventro-basal swelling of the meso- and metafemora (Fig. 19H-I) and having only three rather uniformly spaced teeth on the two ventral carinae of the metatibiae (Fig. 19H). The eggs (Fig. 46K-L) are smaller but bulgier than those of *napalaki*, and readily differ by the much less sculptured capsule surface and larger but more overall narrower micropylar plate, which is about seven-eighths the length of the capsule (only about three-quarters the length of capsule in *napalaki*) and has all three extensions notably longer and slenderer than in *napalaki*.

Variability. – This species shows noteworthy variability in aspect of the size, basically all elements of head and body armature as well as the colouration. The general colour ranges from rather uniformly dark brown (e. g. the lectotype (Fig. 17I) and ♀ from Palanan and Polillo (Fig. 17D-E)) over various tones of brown, buff and ochre. Some ♀ are buff or ochre dorsally with only the thoracic pleurae and lateral surfaces of the abdomen darker brown, a colour pattern that is not seen in ♂. Usually, the medio-longitudinal keel of the thoracic nota is contrastive ochre to orange (e. g. lectotype, Fig. 17I) and quite often there is a dark longitudinal line or streak lateral of the keel. Occasionally, the medio-longitudinal streak is continued but mostly just faintly indicated on the basal abdominal terga. The legs range from plain brown to being unevenly flecked with ochre to clay. Quite frequently, the mesosternum has the three mesosternals marked by a black spot and the meso- and metasternum are notably lighter in colour than the dorsal body surface, being mostly ochre, clay or straw-coloured. The largest elements of the body armature are mostly dark brown to back at the base and tipped with ochre to orange.
Almost all elements of cephalic, thoracic and abdominal armature are subject to quite striking variability, which in particular concerns to the antero-lateral crests of the mesonotal triangular area as well as the meso- and metanotal inter-posterior medials, mesopleurals and metapleural supra-coxals. From the specimens at hand for examination, the ♀ from Dingalan (coll. FH, No. 1104-1, Fig. 17E) and Polillo (coll. FH, No. 1104-6, Fig 17D) best match the lectotype (Fig. 17I) in colour and armature of the head and body. The example

Fig. **17**. *Tisamenus draconinus* (Westwood, 1848) ♀.

A. Dorsal view (captive reared from Callao Cave, Cagayan Province, North Luzon – arrow pointing to the single metapleural that distinguishes *T. draconinus* from the very similar *T. napalaki* **n**. **sp**.) [FH 1104-10]. **B**. Dorsal view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-9]. **C**. Dorsolateral view (captive reared from Callao cave, Cagayan Province, North Luzon) [FH 1104-9]. **D**. Dorsolateral view (Polillo Island) [FH 1104-6]. **E**. Dorsolateral view (Palanan, Cagayan Valley, Isabella Province, East Luzon) [FH 1104-3]. **F**. Lateral view (Palanan, Cagayan Valley, Isabella Province, East Luzon) [FH 1104-3]. **G**. Lateral view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-9]. **H**. Ventral view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-9]. **I**. Lectotype, dorsal view [UMO © Paul D. Brock].

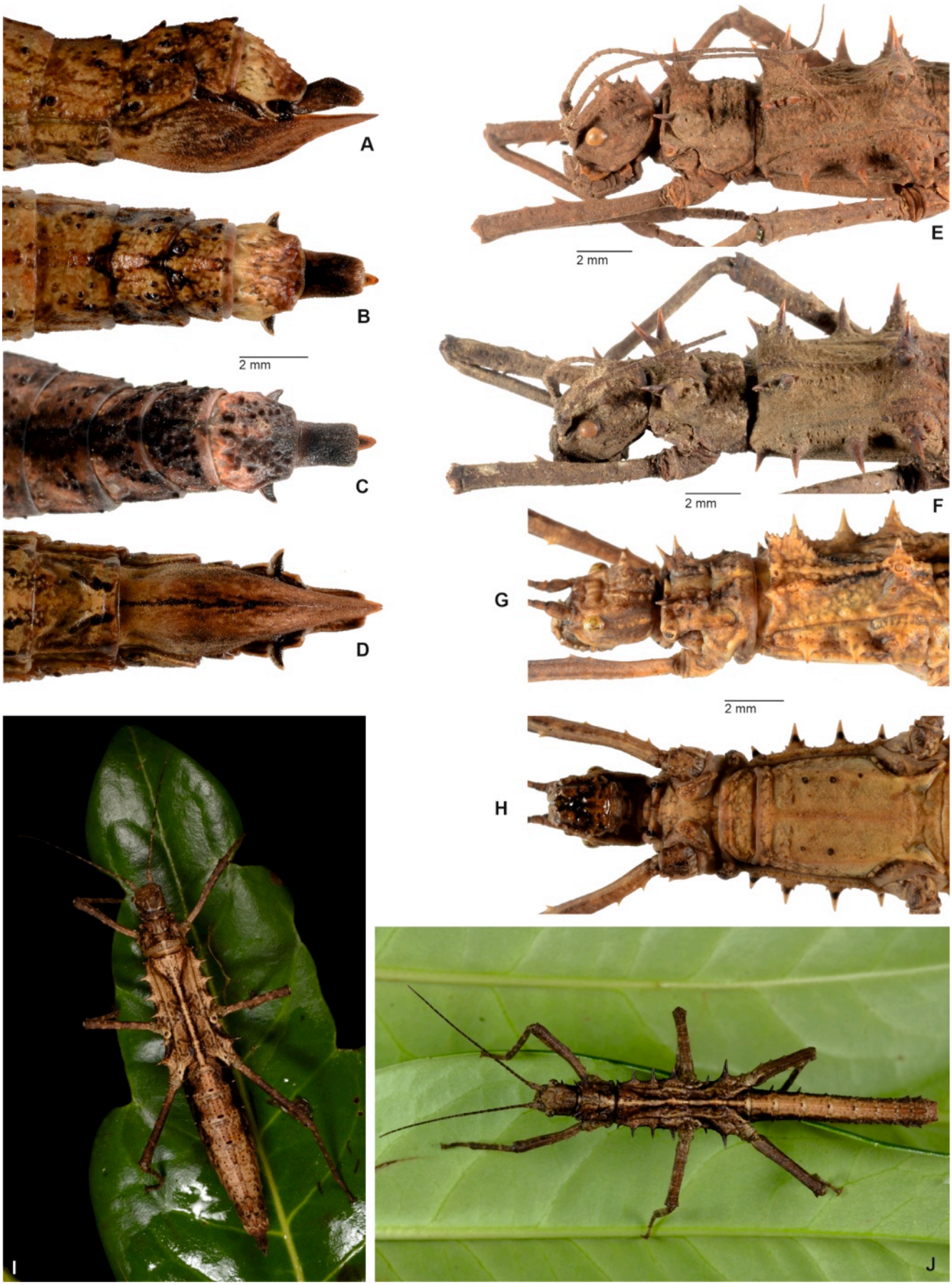

Fig. **18**. *Tisamenus draconinus* (Westwood, 1848).

A. Terminalia of ♀ in lateral view. **B**. Terminalia of ♀ in dorsal view. **C**. Terminalia of ♀ in dorsal view. **D**. Terminalia of ♀ in ventral view. **E**. Closeup of head, pro- and mesonotum of ♀ from Palanan, Cagayan Valley, Isabella Province, East Luzon [FH 1104-3]. **F**. Closeup of head, pro- and mesonotum of ♀ from Polillo Island [FH 1104-6]. **G**. Closeup of head, pro- and mesonotum of captive reared ♀ from Callao Cave, Cagayan Province, North Luzon [FH 1104-9]. **H**. Closeup of pro-, meso- and metasternum of captive reared ♀ from Callao Cave, Cagayan Province, North Luzon [FH 1104-11]. **I**. Live captive reared ♀ from Callao Cave, Cagayan Province, North Luzon. **J**. Live captive reared ♂ from Callao Cave, Cagayan Province, North Luzon.

from Palanan in particular is the one that has all the elements of armature most prominent, while these are least developed in the specimens from Cagayan (Fig. 17A-B, G). The Polillo ♀ has the inter-posterior mesonotals and metanotals very prominent and bifid (Fig. 18F) and the mesopleurals and metapleurals supplied with several smaller spines and tubercles around the base, whereas these latter pleural elements are merely simple spines in all of the specimens from Cagayan. While the lectotype shows the same compound mesopleurals and metapleurals, the inter-posteriors of the meso- and metanotum are rather small and simple, paired spines (Fig. 17I). The inter-posteriors are represented by multi-tuberculate, compound but rather low conical tubercles in the samples from Cagayan (Fig. 17G) and at the other extreme are protruded into large and prominent, compound spinose swellings in the ♀ from Dingalan (Fig. 17F). While the Cagayan specimens and lectotype have the posterior mesal of abdominal terga II-IV small and tubercular, it is represented as a prominent and long spine in the ♀ from Palanan and Polillo, that is scarcely shorter than the huge second paired posteriors; moreover, it is also present on tergum V in these two specimens but merely tubercular. The anterolateral crests of the mesonotal triangular show numerous varieties, being basically trifid but with a variable number of much smaller intercalated spikes (Fig. 18E-G). The range of variability of the head and body armature is notably smaller in ♂, all of which are at hand lack any additional basal tubercles at the mesopleurals or metapleurals. The ♂ from Leyte in the author's collection (coll. FH, No. 1104-48) differs slightly from all other Luzonian specimens by having some smaller intercalated teeth between the three major ventral teeth of the metatibiae and the comparatively somewhat more deeply excavated posterior margin of the anal segment.

Westwood (1848: 78) noted body lengths of 57.0 mm for the ♀ lectotype and 38.5 mm for the ♂ paralectotype in the collection of UMO, thus these two specimens being on the smaller side of the size range of *draconinus*. The full ranges of body lengths of all examined specimens are 55.0-63.8 mm for ♀ and 38.0-47.5 mm for ♂. Due to the morphological differences between populations from different localities partly summarized above, some full sets of measurements are here given in tables 1 and 2 below.

Egg (Fig. 46K-L)

Large for the genus; capsule ovoid, slightly constricted just below anterior margin with the dorsal surface distinctly bulgier than ventral surface and the polar-area with a flattening to very shallow indention dorsally; oval in cross-section and notably higher than wide with capsule 1.5x longer than wide. Surface densely but unevenly covered by small irregularly clustered wart-like protuberances; these missing anteriorly to leave a smooth rim just below the minutely granular anterior margin. Micropylar plate large and about 0.8x as long as capsule; rather narrowly Y-shaped with the median portion large, almost uniform in width and approaching the lower margin of the unarmed rim at anterior margin of capsule; the two posterolateral extensions gradually tapering towards a fairly narrow tip that notably surpassing the axis of the egg if seen laterally. Posterior portion 90° but roundly V-shaped with a fairly distinct bowl-shaped micropylar cup in centre. Outer margin of plate somewhat raised and marked by about three parallel rows of fringe-like excrescences, the interior portion raised and sculptured like capsule and a fairly broad and indented rim in between the outer margin and sculptured inner portion of the plate smooth. Median line indistinct and seen to be a shallowly raised and rather short carina. Operculum almost round in outline and weakly convex; near outer margin with a collar of irregular fringy to peg-like excrescences as well as a broad inner rim of similar but gradually prolonging excrescences; only the centre unarmed. Colour dark brown with all the protuberances of the capsule and micropylar plate ochraceous to pale grey; the operculum rather blackish brown with the fringy excrescences grey. The example from Polillo (coll. FH, No. 1104-E2) is slightly more elongate in shape than all other examined eggs and almost black with the sculpturing of the capsule less contrasting in colour and comparatively less developed. Measurements [mm]: Length incl. operculum 4.2, length 4.0, width 2.7, height 3.1, length of micropylar plate 3.3.

Remarks. – This species was originally described upon a ♀ and a ♂ from an unspecified locality in the collection of UMO, of which (Bragg, 1995: 27) designated the ♀ as the lectotype (Fig. 17I). Westwood (1848, plate 38: 5) only illustrated the ♀ and therefore detailed illustrations, also showing the noteworthy intraspecific variability, of both sexes are presented herein. The egg is here described and figured for the first time (Fig. 46K-L).

Matsumura & Hirayama (1932) illustrated an immature ♀ identified as "*Hoploclonia draconina*" from Kotosho Island southeast of Taiwan based on a unique specimen in the collection of NTUC. The identity of the specimen was doubted by Shiraki (1935: 24) and illustrations of the specimen were provided by Huang (2002) as well as Chen & He (2008). These clearly show the specimen to be misidentified and to represent *T. napalaki* **n**. **sp**. instead. The record is very doubtful, since *Tisamenus* is an endemic of the Philippines, and thus can be regarded as not natural. However, it is not be entirely ruled out that a specimen was floated to Kotosho Island during a typhoon, usually northing storms that come from the Philippines and hit the south-eastern regions of Taiwan. The Luzon Strait, that separates the Philippines to the South and Taiwan to the north, is merely about 300 kilometres wide and within it lie the Babuyan Islands and Batanes Islands that might act as a land connection. Moreover, *T. napalaki* **n**. **sp**. is distributed in the very northeast of Luzon and on the island of Palaui, although no records are yet known from the Babuyan or Batanes Islands.

A ♂ in the author's collection (coll. FH, No. 1104-48) from the island of Leyte, one of the Eastern Visayas islands, fully matches with Luzonian specimens of *T. draconinus*, except for the slight traits mentioned above. However, since all other known records suggest this species to be restricted to northern Luzon, a distribution on Leyte appears fairly doubtful and thus, the locality data might be erroneous.

This species is commonly reared in Europe originating from two very differently coloured ♀ that were collected by Thierry Heitzmann (Philippines) and Albert Kang (Singapore) close to Callao Cave, Cagayan Province, North Luzon in November 2015. This sexual culture stock has since been distributed as *Tisamenus* sp. 'Cagayan' and is the perhaps most widespread of all *Tisamenus* spp. Among European cultures. This is mainly due this species has proven exceedingly productive and fast developing. Although very common and widely spread throughout European breeders no culture number has yet been attributed by the Phasmid Study Group.

Distribution. – "Philippines" [UMO – type locality]). N-Luzon: Province Aurora (Sierra Madre, Dingalan, 230 m [FH]); Province Isabela (Sierra Madre, Cagayan Valley, Palanan [FH]; San Pablo [RBINS, TB]; Province Cagayan (Peñablanca Municipilatity, near Callao Cave [FH]); Province Quezon (Polillo Island [FH]); Mountain Province (Apayao, Ripang [ANSP]). Leyte: Province Leyte (Mahaplag [FH]).

Tisamenus hebardi (Rehn & Rehn, 1939)

(Fig. 20-21, 46M-N)

Ilocano hebardi Rehn & Rehn, 1939: 461, pl. 31: 3 (♀).

HT, ♀: Baguio, Benguet, Luzon. P.I, (E.H. Taylor), VII.1923; *Ilocano hebardi* Rehn + Rehn Type H.1343; Data Base Serial No. Assigned as Type No. September 2008. Type # 9130 [ANSP].

- Otte, 1978: 79. (Type data)

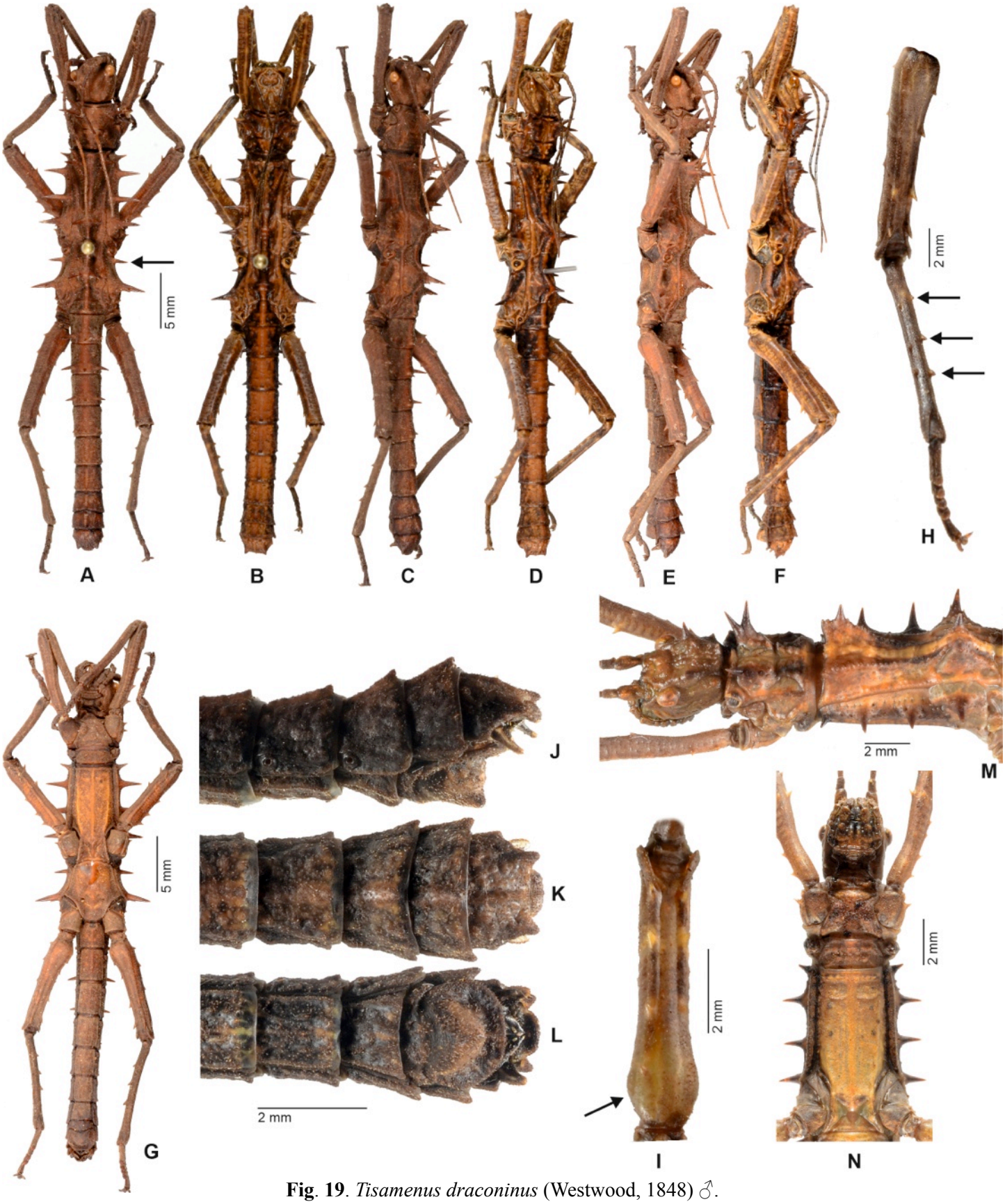

Fig. **19**. *Tisamenus draconinus* (Westwood, 1848) ♂.

A. Dorsal view (Palanan, Cagayan Valley, Isabella Province, East Luzon – Arrow indicating the single metapleural that distinguishes *T. draconinus* from the very similar *T. napalaki* **n**. **sp**.) [FH 1104-4]. **B**. Dorsal view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-44]. **C**. Dorsolateral view (Palanan, Cagayan Valley, Isabella Province, East Luzon) [FH 1104-4]. **D**. Dorsolateral view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-44]. **E**. Lateral view (Palanan, Cagayan Valley, Isabella Province, East Luzon) [FH 1104-4]. **F**. Lateral view (captive reared from Callao Cave, Cagayan Province, North Luzon) [FH 1104-44]. **G**. Ventral view (Palanan, Cagayan Valley, Isabella Province, East Luzon) [FH 1104-4]. **H**. Anteroventral view of right hind leg (arrows indicating the characteristic three ventral teeth of the metatibiae). **I**. Ventral view of mesofemur showing the characteristic incrassate base. **J**. Terminalia in lateral view. **K**. Terminalia in dorsal view. **L**. Terminalia in ventral view. **M**. Closeup of head, pro- and mesonotum (captive reared from Callao Cave, Cagayan Province, North Luzon). **N**. Closeup of pro-, meso- and metasternum (captive reared from Callao Cave, Cagayan Province, North Luzon).

- Zompro, 2004: 208, fig. (♀).
- Otte & Brock, 2005: 164.
- Hennemann *et al.,* 2016: 21, fig. 60 (♀).

Tisamenus hebardi, Bank et al., 2021: 13.

- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Material examined

3 ♀, **5** ♂, **1** egg: Coll. R.I.Sc.N.B., Philippines, Luzon, Mt Prov. Sagada, Mt Polis, 2000m+, 16°57'40"N 121°1'18"E, Mossy For., 15.iv.2014, IG: 32700, Mission Leopold III Funds, Constant J., Bresseel J. & co. [RBINS];

1 ♀ (penultimate instar): Coll. R.I.Sc.N.B., Philippines, Ifugao, XI.2013, Leg. T. Heitzmann [RBINS].

Differentiation. – This is the smallest representative of the genus and particularly distinctive in that the cephalic, thoracic and abdominal armature is much reduced to almost entirely wanting. In both sexes the head merely bears a pair of low sub-laminate post-orbital crests and there are no supra-orbital spines, the pronotum only has two posteriorly convergent rows of low granules (♀, Fig. 20E) or tubercles (♂, Fig. 21G), the meso- and metapleural supra-coxals are only represented by low rounded nodes and there are no hints of posteriors on the abdominal terga. In ♀ the mesonotal triangular area is merely indicated by two low posteriorly convergent carinae that anteriorly terminate in an obtuse tubercle, whereas the triangular area is more evident in ♂ with the carinae somewhat produced triangularly at the anterolateral angles; in both sexes the triangular area scarcely reaches to the middle of the mesonotum. Overall, this species comes morphologically closest to *T. charestae* **n**. **sp**. and *T. ranarius* (Westwood, 1859) but both species are notably larger and furthermore separable by the characters mentioned above. The eggs (Fig. 46M-N) readily differ from those of all other known eggs of congenerics by the very short posterior extensions of the micropylar plate, which only form two rounded lobes that hardly reach towards the lateral surfaces of the capsule.

Description

♂ (Fig. 21)

Form and colouration. – Size very small (body length 18.1-18.9 mm); form rather stout, legs of average length for the genus with only the metafemora weakly incrassate basally; elements of armature essentially as in ♀ but much more pronounced and obtuse, the surface texture of body minutely sub-granulose. Mesothorax almost rectangular with the pleurae gently convex pre-medially. General colour fuscous with all the elements of

Table 1: Measurements [mm] of ♀♀ of *Tisamenus draconinus* (Westwood, 1848).

	♀ **from Polillo** [FH, No. 1104-6]	♀ **from Palanan**, **Prov. Isabela** [FH, No. 1104-3]	♀ **from Dingalan, Prov**. **Aurora** [FH, No. 1104-1]	♀♀ **captive reared from Cagayan** [FH]
Body	63.8	62.0	63.0	56.5-61.5
Pronotum	5.3	5.1	5.2	4.3-5.0
Mesonotum	10.4	9.6	10.3	9.5-10.0
Metanotum	5.3	5.3	5.6	4.7-5.0
Median segment	2.7	2.7	2.7	2.3-2.6
Profemora	11.2	10.5	11.2	10.0-10.3
Mesofemora	10.1	9.8	10.3	9.1-10.0
Metafemora	13.2	13.7	14.5	13.5-14.0
Protibiae	12.2	11.7	12.6	9.8-10.3
Mesotibiae	10.8	10.8	10.7	9.2-9.4
Metatibiae	14.8	15.5	15.7	12.9-13.5
Antennae	-	*ca.* 22.0	24.0	18.0-20.3

Table 2: Measurements [mm] of ♂♂ of *Tisamenus draconinus* (Westwood, 1848).

	♂♂ **from Palanan**, **Prov. Isabela** [FH, No's 1104-4 & 5]	♂ **from Leyte** [FH, No. 1104-48]	♂♂ **captive reared from Cagayan** [FH]
Body	47.0-47.5	42.2	39.5-45.5
Pronotum	4.6	3.6	3.4-3.8
Mesonotum	7.8-7.9	7.2	7.9-8.2
Metanotum	4.3	3.5	3.7-4.0
Median segment	2.5	2.0	2.0-2.3
Profemora	9.6-9.7	8.0	8.0-8.4
Mesofemora	8.1-8.3	7.6	7.0-7.8
Metafemora	10.1-10.3	9.8	9.1-10.0
Protibiae	9.4	7.9	7.3-8.8
Mesotibiae	7.8-7.9	6.4	6.4-6.7
Metatibiae	10.5-11.0	9.7	9.0-10.0
Antennae	*ca.* 22.0	> 13.0	15.0-16.0

cephalic and thoracic armature and the medio-longitudinal keel of dorsal body surface buff to mid brown, posterior portion of meso- and most of metasternum tawny and the meso- and metafemora slightly lighter ventrally. Antennae dark brown with the terminal twelve joints dark ochre to orangey brown; the terminal antennomere black at the tip (Fig. 21G).

Head. – Large, roundly sub-rectangular and scarcely longer than wide with the genae roughly parallel-sided but weakly convex. Armature essentially as in ♀; the supra-orbitals prominent sub-laminate, obtusely tri-tubercular crests with the conical second point largest and covering most of the distance from back of eye to coronals; supra-antennals represented by a pair of low but wide nodes; occipitals sub-obsolete and the median and lateral coronals rather low and obtusely tuberculate. Genae only supplied with two very small, granular gulars posteriorly (Fig. 21G). Eyes of moderate size, hemispherical and their diameter corresponding to roughly half the length of gena. Antennae consisting of 24 joints, strong and perlamorph with all the antennomeres, except for the three basal ones and the terminal one short and globose to barrel-shaped; scapus trapezoidal and longer than wide, pedicellus much narrower and about two-thirds as long as scapus and round in cross-section; III elongate and slightly longer than pedicellus, IV only one-third the length of III, following joints up to about XI very slightly increasing in length, then decreasing with the terminal antennomere much elongated and almost as long as four preceding joints taken together.

Thorax. – Pronotum trapeziform, transverse and notably wider than long with anterior margin triangularly concave; triangular area distinct with posteriorly convergent margins obtusely nodose, the anteriors large and expanding over entire pre-sulcal area, obtuse tri- or quadri-tubercular; transverse median sulcus distinctly indented (Fig. 21G). Mesothorax basically rectangular with a slight narrowing pre-posteriorly, about 2x longer than prothorax and scarcely longer than wide. Mesonotum rectangular with lateral margins shallowly concave and the pre-posterior lateral areas somewhat gibbose, 1.5x longer than wide; the triangular area much more distinct than in ♀, rather large, attaining middle of notum, and roughly an isosceles triangle; disk deeply concave in centre and the very gently arched converging outer margins weakly granular and increasingly raised towards the anterior angle; the anterior margin swollen and with two low median nodes (Fig. 21G); posterior portion of mesonotum with a shallowly granular medio-longitudinal bulge posterior to triangular area. Mesopleurae strongly expanded and gently convex in the anterior two-thirds with a slight narrowing pre-posteriorly; laterals much more pronounced than in ♀ and represented by four obtuse low tubercles; mesopleural a rather small and low conical tubercle. Metanotum about as long as wide with posterior margin distinctly concave and with a shallowly granular medio-longitudinal bulge. Metapleurae with laterals just very weakly indicated, the metapleural a somewhat more pronounced low swelling and the supra-coxal angle with a short and obtuse bifid supra-coxal tubercle. Probasisternum with a widely spaced pair of distinct nodes; the sensory areas of prosternum weakly developed. Mesosternum densely and unevenly granular and with faint indications of three longitudinal carinae; metasternum only with a rather shallow medio-longitudinal carina (Fig. 21D).

Abdomen. – Median segment almost semi-circular in outline, obtusely carinate medio-longitudinally. Segments II-VII slightly sub-uniform in length but roughly uniform in width, all transvers with V longest; II sub-trapeziform. Terga II-VII all with a shallow medio-longitudinal carina that is indicated by about four low granules and with paired second posteriors merely represented by low nodes. Sterna II-VII with a faintly indicated medio-longitudinal carina. Terga VII-IX with a posteromedian swelling that is formed by a protrusion of the medio-longitudinal carina and is most prominent and obtusely conical on IX (Fig. 21E); the latter about 2x wider than long. Anal segment slightly wider than long but noticeably longer than preceding segment; sub-rectangular, moderately declining and with lateral margins somewhat deflexed at the median angle; posterior margin with a wide, concave emargination and the outer angles obtusely rounded. Epiproct transverse, widely rounded. Vomer black, broad with base transverse and the terminal hook somewhat displaced towards the right, short, weakly arched inwards and sharply up-curved; the ventral surface of basal portion shallowly concave medially (Fig. 21F). Poculum bulgy, angularly cup-shaped with a very broad and weakly bi-labiate posterior flange of the free upper margin, that reaches back no more than about one-quarter the way along anal segment (Fig. 21E-F).

Legs. – Moderately stocky, much heavier with armature much more pronounced than in ♀; the armature of front and mid legs however obtuse, which concerns to the dorsal dentate swellings in particular. Pro- and mesofemora about as long as mesothorax, metafemora reaching to posterior margin of abdominal segment V and metatibiae almost reaching to tip of abdomen. Pro- and mesofemora with only two blunt teeth in apical one-third of outer ventral carinae distinct; the four dorsal protrusions of all three femora uneven, obtuse and scarcely dentiform. Metafemora with ventral-basal swelling very shallow and armed with four obtusely spiniform teeth on ventral carinae, the apical ones of which are more pronounced. All four carinae of metatibiae with 3-4 obtuse swellings, only the apical ventral one of which is weakly dentiform. Basitarsi short and about as long as following two tarsomeres taken together.

Measurements [mm]. – Body 18.1-18.9, pronotum 1.7, mesonotum 2.8-2.9, metanotum 1.4-1.5, median segment 1.0-1.1, profemora 3.1-3.2, mesofemora 3.0, metafemora 4.1-4.2, protibiae 3.6–3.8, mesotibiae 3.1-3.4, metatibiae 4.0-4.6, antennae 6.1-6.3.

Variability. – No significant morphological variability is seen in the series of specimens at hand. It is however noteworthy that that the holotype ♀ in the collection of ANSP has all of the elements of cephalic and thoracic armature including the triangular mesonotal area less developed than all other examples and is of a lighter tawny general colour with a broad, washed fuscous medio-longitudinal streak along the dorsal body surface (Fig. 21I). The less developed triangular mesonotal area certainly was one reason that prompted Rehn & Rehn (1939: 460) to describe a new genus for this diminutive species. Although these authors did not mention the presence of a triangular area on the mesonotum, careful examination of the holotype shows there to be two weakly indicated convergent carinae that vanish some distance before they would join. In the other specimens at hand these two carinae are much more distinct but also don't merge posteriorly. Interestingly, and representing a state that is unique within the whole of *Tisamenus*, is that the triangular mesonotal area is relatively much larger and different in shape and texture in ♀ than in ♂. Body length of ♀ 28.2-31.0 mm.

Egg (Fig. 46M-N)

Small for the genus; capsule ovoid but widest somewhat below anterior margin, the dorsal surface just slightly more convex than ventral surface, slightly oval in cross-section, higher than wide and capsule 1.5x longer than wide. Anterior margin somewhat inflated and covered with a collar of fringy excrescences and the capsule with a shallow constriction below anterior margin. Surface densely but very minutely granular and unevenly covered irregularly shaped peg-like or fringy protuberances; these most distinct and numerous at polar-area and wanting in the constricted anterior region. Micropylar plate small but broad and staying clearly away from the anterior margin of the capsule and the two posterolateral extensions small and obtusely rounded; the posterior portion with a 70° V-shaped indention that has a small bowl-shaped micropylar cup in centre. Outer margin of plate marked by an irregularly granular bulge; only the interior portion of surface in lower half with sculpturing similar to that of capsule; the outer portions destitute of noticeable sculpturing. Median line shallow longitudinal, granular carina that almost reaches to the polar end of capsule. Operculum oval with the central portion gibbous and densely covered with a broad rim of fringy excrescences; similar but shorter excrescences along outer margin and a few irregular but radially directed carinae or rugulae in between. Colour quite uniformly greyish mid brown, the outer margin of the micropylar plate, micropylar cup and the protuberances of the capsule dark brown. Measurements [mm]: Length incl. operculum 2.9, length 2.7, width 1.8, height 2.0, length of micropylar plate 1.8.

Remarks. – This diminutive mountainous species was generically misinterpreted by Rehn & Rehn (1939: 460), who described the genus Ilocano to comprise *hebardi* and *T. ranarius* (Westwood, 1859). These authors suggested an intermediate position between the genera *Tisamenus* (referred to as *Hoploclonia* Stål, 1875) and *Eubulides* Stål, 1877 but molecular data have clearly shown *hebardi* to be deeply nested within species of *Tisamenus*, why Ilocano was synonymised with *Tisamenus* by Bank et al. (2021: 14). The previously unknown ♂ and egg are her formally described and illustrated in detail. The penultimate instar ♀ in the collection pf RBINS has the mesopleural

Fig. 20. *Tisamenus hebardi* (Rehn & Rehn, 1939) ♀ from mossy forest at 2000 m on Mount Polis, Sagada, Mountain Province, North Luzon [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Closeup of head, pro- and mesonotum. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I**. Live ♀ with a broad ochraceous medio-longitudinal dorsal streak on most of body near San Antonio, Dupax del Norte, Province Nueva Vizcaya, North Luzon [© Albert Kang https://inaturalist.ca/observations/57616113].

armature much more developed than adult specimens and represented by five fairly prominent spiniform but obtuse tubercles (Fig. 21J-K). Breeding was attempted in Europe from stock collected by Joachim Bresseel (RBINS), Jérôme Constant (RBINS) and Thierry Heitzmann (Philippines) in a cloud forest habitat at an altitude of over 2000 metres near Sagada, Mount Polis, Mountain province, N-Luzon in April 2014. While specimens could be maintained alive on bramble (Rubus spp., Rosaceae) in Belgium breeding was not successful.

Distribution. – North Luzon: Province Benguet (Baguio [ANSP – type locality]); Mountain Province (Sagada, Mount Polis 2000 m [RBINS]); Province Ifugao (unspecified [RBINS]; Banaue [photographic records by Albert Kang: https://inaturalist.ca/observations/57719470, https://inaturalist.ca/observations/57611612, https://inaturalist.ca/observations/57611537]; Dupax del Norte San Antonio [photographic record by Albert Kang: https://inaturalist.ca/observations/57616113]).

***Tisamenus heitzmanni* n. sp.**

(Fig. 22)

ZooBank: https://zoobank.org/A383FD8E-4306-472E-B746-5BAD22CB27B3

Tisamenus sp. 8 (Cebu), Bank *et al.,* 2021: Fig. 6-7.

HT, ♂: Cebu, Philippinen, leg. Heitzmann, 2014 [ZMK, ex coll. TB].

Differentiation. – The ♂ of this new species (the only sex known) is morphologically very close to *T. hystrix* (Rehn & Rehn, 1939) from the island of Sibuyan but differs by the stockier shape and relatively shorter body segments with the mesonotum being only 2x longer than wide (almost 2.5x in *hystrix*), more gradually broadening mesothorax, having six instead of five very strong mesopleural spines, lacking the strong pair of inter-posterior meso- and metanotals and pair of spines on the median segment as well as abdominal terga IV and V seen in

Fig. **21**. *Tisamenus hebardi* (Rehn & Rehn, 1939).

A-G. ♂ from mossy forest at 2000 m on Mount Polis, Sagada, Mountain Province, North Luzon [RBINS]. **A**. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Terminalia in lateral view. **F**. Terminalia in ventral view. **G**. Closeup of head, pro- and mesonotum. **H**. Live ♂ at Banaue, Ifugao Province, North Luzon [© Albert Kang https://inaturalist.ca/observations/57611612]. **I**. Live couple at Langawe, Banaue, Ifugao Province, North Luzon [© Albert Kang https://inaturalist.ca/observations/57719470]. **J**. Penultimate instar ♀ from Banaue, Ifugao Province, dorsal view [RBINS]. **K**. Penultimate instar ♀ from Banaue, Ifugao Province, dorsolateral view [RBINS].

hystrix, basally more incrassate metafemora and presence of distinct ventral teeth of the metatibiae (metatibiae unarmed in *hystrix*). The ♀ is only known from a photograph of a live specimen taken at Nug-as Forest Reserve, Sibuyan (https://www.inaturalist.org/observations/40873074) and most closely resembles that of *T. clotho* (Rehn & Rehn, 1939) in general shape, but can readily be separated by the typical thoracic armature also seen in the ♂, which includes six instead of five mesopeural spines.

Etymology. – Named after Thierry Heitzmann (Philippines), the collector of this species, for his great efforts in searching for Phasmatodea throughout the Philippines and providing European breeders with numerous culture stocks.

Description

♂ (Fig. 22)

Form and colouration. – Size small for the genus (body length 32.2 mm); general form rather heavy, legs fairly strong with metafemora moderately incrassate; elements of armature very prominent with strong and pointed meso- and metapleural spines. General colour fuscous with the raised carinae of the thorax and most spines russet and tipped with black, the legs dark buff, the meso- and metasternum slightly lighter in colour with the medio-longitudinal keel tawny and the femora with faint tawny markings ventrally. Antennae drab with the terminal twelve joints shiny and slightly lighter in colour and the terminal antennomere buff.

Head. – Sub-quadrate, scarcely longer than wide with the genae weakly convergent towards the posterior. Anterior supra-orbitals large and spinose, the second and third notably smaller and tubercular; occipitals small tubercular; median and lateral coronals larger than occipitals, tuberculate, the lateral coronals weakly bifid (Fig. 22H). Eyes fairly large, almost hemispherical and their diameter corresponding to about 0.6x length of gena. Genae supplied with two low, nodular gulars. Antennae roughly reaching to tip of protarsi and consisting of 24 joints; scapus slightly triangular in dorsal aspect with interior margin weakly rounded, pedicellus about half the length of scapus and round in cross-section; III notably longer than pedicellus, IV much shorter and sub-globose, the following joint up to XI slightly increasing in length, then very weakly decreasing with the terminal antennomere much elongated and about as long as preceding two joints combined.

Thorax. – Pronotum sub-quadrate with lateral margin gently convex; triangular area moderately developed with convergent margins bounded by small tubercular elements and anterolaterally with a huge bifid spine, whose spikes are gently arched backwards (Fig. 22H). Mesothorax broad, slightly, gradually widening towards the posterior; about 2.2x longer than prothorax and with posterior portion 1.3x wider than anterior margin. Mesonotum sub-trapeziform with lateral margins very slightly convergent towards the posterior and with a distinct narrowing post-medially; about 1.8x longer than width at anterior margin; the triangular area prominent, slightly surpassing middle of notum, a little longer than wide, disk indented and shallowly concave and the convergent margins shallowly granulate with the anterolateral angles protruded into a large upright spine that is almost as hight as the anterior pronotals (Fig. 22H); posterior portion of mesonotum with a prominently raised shallowly granulate medio-longitudinal bulge; the posterior portion of the bulge with a closely spaced pair of small, glossy nodes. Mesopleurae notably expanding towards the posterior and armed with five long and strong, spinose laterals, that gradually increase in size from anterior to posterior; mesopleural largest of all mesopleural spines; all gently arched; supra-coxal small and obtusely tubercular. Metanotum trapezoidal with lateral margins weakly convex, a little longer than wide and with the same granulose medio-longitudinal keel seen on mesonotum. Metapleurae with two slender, spinose laterals; metapleural conical, tubercular and the supra-coxal angle with a strong and huge bifid supra-coxal spine /the posterior spike much smaller although). Mesosternum rather faintly tri-carinate with the lateral carinae supplied with a few very shallow node-like mesosternals; metasternum with a shallow medio-longitudinal carina and two small node-like metasternals laterally.

Abdomen. – Median segment strongly trapeziform with anterior margin only half the width of posterior margin, disc distinctly carinate medio-longitudinally. Segments II-VI very slightly decreasing in width and notably decreasing in length, all transverse with VII roughly 2x wider than long. Terga II-IV with a strong pair of paired second posterior spines, which slightly decrease in size from II towards IV; second paired posteriors only represented by small tubercles on V. All terga shallowly and obtusely tectate medio-longitudinally, the keel protruded posteriorly on VI-IX with the protrusion increasingly raised and dentiform towards IX. Sterna II-VI with a fine medio-longitudinal carina. Terga VIII and IX with node first paired posteriors and shortest of all segments, being wider than VII and roughly 3x wider than long. Anal segment longer than IX, somewhat transverse, declining and narrowed in the posterior section with lateral margins almost rectangular with the angle somewhat deflexed laterally; dorsal surface with an obtuse and low medio-longitudinal bulge and with a pair of nodose anteriors; posterior margin with a broad and very shallow, concave median excavation, the outer angles obtuse and somewhat protruded laterally (Fig. 22F). Epiproct distinct, shield-shaped, transverse, rounded and somewhat projecting beyond anal segment. Vomer very broad, distinctly transverse, almost symmetrical with a short upcurved terminal hook. Poculum angularly cup-shaped with an obtuse central protrusion at the angle; the free upper margin broadly labiate (Fig. 22G), somewhat down-curved and shallowly indented posteromedially.

Legs. – All rather stocky with the femora but metafemora in particular somewhat incrassate; all femoral teeth fairly distinct and acute, the two apical ventral ones in particular slender and somewhat spiniform. Profemora scarcely, mesofemora notably shorter than mesothorax, metafemora almost reaching posterior margin of abdominal segment V and metatibiae surpassing tip of abdomen by a little more than length of anal segment. Ventro-basal swelling of metafemora gibbose, smooth (Fig. 22E); the three teeth of dorsal carinae increasing in size towards base of femur. Metatibiae smooth dorsally and with about six plus a few smaller intercalated rather sharp teeth ventrally. Basitarsi short and a little longer than following two tarsomeres taken together.

Measurements of holotype [mm]. – Body 32.3, pronotum 3.1, mesonotum 6.7, metanotum 3.4, median segment 1.9, profemora 6.4, mesofemora 5.6, metafemora 6.8, protibiae 6.7, mesotibiae 5.8, metatibiae 7.2, antennae 12.5.

Remarks. – The holotype is the voucher specimen of the sample sequenced for the molecular study by Bank *et al.* (2021) and referred to as "*Tisamenus* sp. 8 (Cebu)". Female and egg unknown.

Distribution. – Cebu, endemic [RBINS – type locality]; Alcoy, Nug-as Forest Reserve [photographic record by Aloke Sahu: https://www.inaturalist.org/observations/40873074].

Tisamenus hystrix (Rehn & Rehn, 1939)

(Fig. 23-24)

Hoploclonia hystrix Rehn & Rehn, 1939: 469, pl. 32: 16 (♂).

HT, ♂: Island Sibuyan, Baker; Type No. 53313 U.S.N.M.; *Hoploclonia hystrix* Rehn & Rehn Type [USNM];
PT, ♀ (penultimate instar): Island Sibuyan, Baker; Type No. 53313 U.S.N.M.; *Hoploclonia hystrix* Rehn & Rehn Allotype Paratype [USNM].

Tisamenus hystrix, Zompro, 2004: 206.

- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann *et al.,* 2016: 134, figs. 70a-c (egg).
- Hennemann, 2023b: 128.

Material examined

2 ♀, **1** ♂: Coll. R.I.Sc.N.B., Philippines, Sibuyan, VI.2014, A. Kang [RBINS];

1 ♂, **1** ♀: Philippinen, Province Romblon, Sibuyan Island, local collector VIII. 2012 [FH, No's 1263-4 to 5];

1 ♀, **2** ♂: ex Zucht Holger Dräger 2021, Herkunft: Philippinen, Sibuyan Id., Rombon-Islands, leg. A Kang VI.2014 [FH, No's 1263-1 to 3].

Differentiation. – Namely, this distinctive species is characteristic for having all the elements of armature of the head and body very long, slender and acutely spinose. Morphologically it is closest to *T. clotho* (Rehn & Rehn, 1939) and *T. lachesis* (Rehn & Rehn, 1939) but it is an endemic of Sibuyan Island and therefore geographically separated from these two Luzonian species. From *clotho* ♀ may be

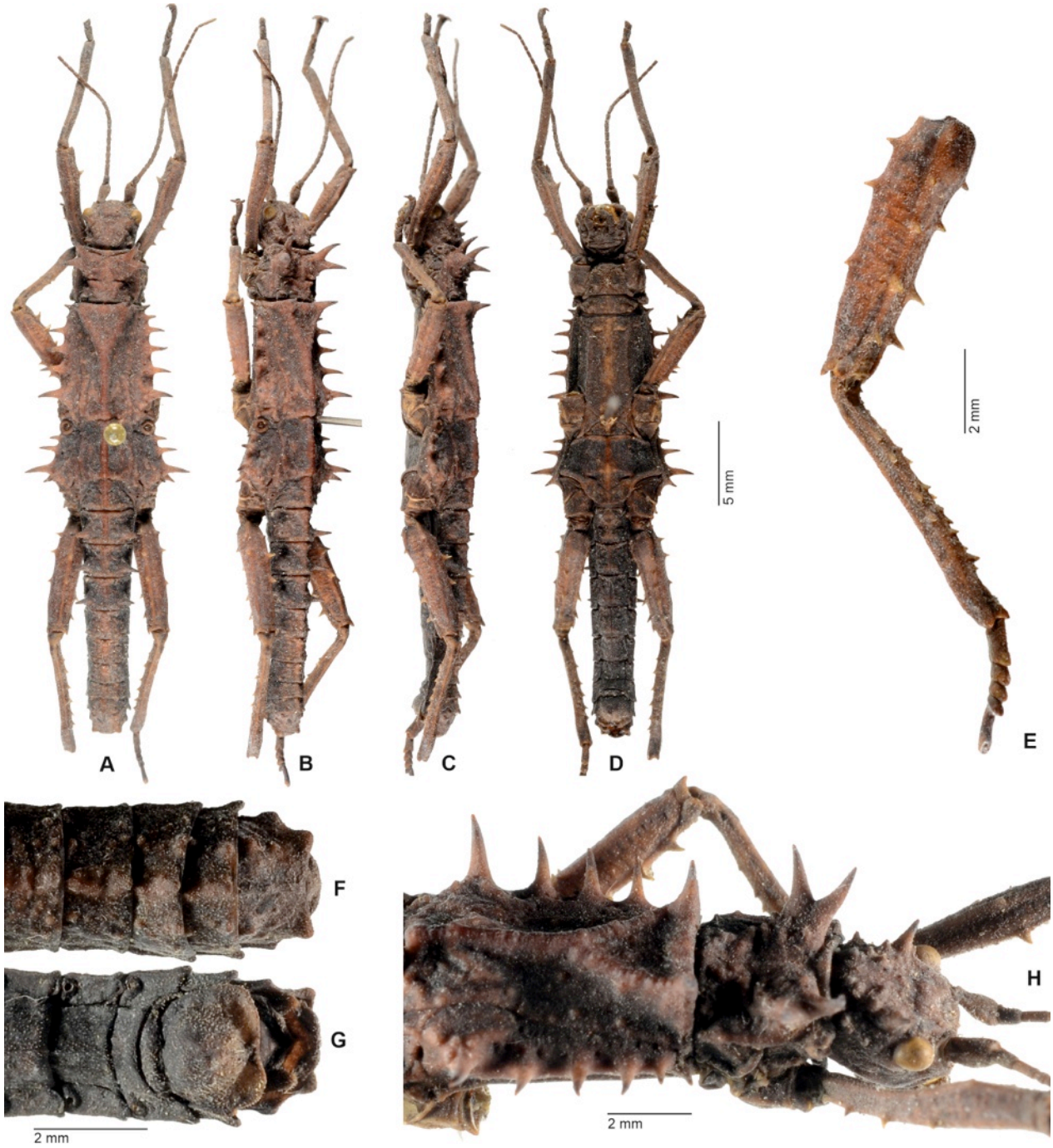

Fig. **22**. *Tisamenus heitzmanni* **n**. **sp**. ♂ HT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D:** Ventral view. **E**. Anteroventral view of right hind leg. **F**. Terminalia in dorsal view. **G**. Terminalia in ventral view. **H**. Closeup of head, pro- and mesonotum.

separated by the slightly smaller dimensions but notably slenderer shape with slenderer and relatively longer legs (Fig. 23A-E), the metatibiae of which roughly reach to the apex of the ovipositor. There is a prominent pair of posteriors on abdominal terga II-V but there often is a pair of posteriors also on abdominal terga VI and VII and often there also is a variably sized triangular posterior mesal on all abdominal terga and a small pair of inter-posterior mesonotal tubercles on the meso- and metanotum, whereas in *clotho* there are never posteriors on VI-VII and the posterior mesal is small and rather conical. Males are easily distinguished from those of *clotho* by the slenderer shape and more elongate legs with the metafemora in particular much less incrassate (Fig. 24A-E), the presence of a spinose pair of inter-posterior meso- and metanotals (Fig. 24B, E) and a pair of distinct posteriors on abdominal tergum V and occasionally also VI (only on II-IV in *clotho*) and lack of the ventro-basal swelling of the metafemora (Fig. 24F). From the notably larger *lachesis* both sexes of this species are easily distinguishable by the stockier overall shape, relatively longer body segments, more widened meso- and metapleurae and smaller mesonotal triangular area, which is scarcely longer than it is wide across the anterolateral angles and not reaching the middle of the mesonotum (distinctly longer than wide and reaching beyond the middle of the mesonotum in *lachesis*). Moreover, *lachesis* never has definite posteriors on abdominal terga VI and VII and the inter-posterior meso- and metanotals may be wanting. The eggs resemble most closely those of *clotho* but differ by lacking the anterior constriction of the capsule seen in eggs of *clotho*, having the posterolateral extensions of the micropylar plate shorter and broader and having the sculpturing of the capsule more pronounced than in *clotho*. From the eggs of *lachesis* they differ by the shorter and considerably fewer fringes or setae of the capsule surface, longer and

Fig. **23**. *Tisamenus hystrix* (Rehn & Rehn, 1939) ♀ [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Dorsal view [FH 1263-4]. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H:** Terminalia in ventral view. **I**. Closeup of pro-, meso- and metasternum. **J**. Closeup of head, pro- and mesonotum.

broader posterolateral extensions and narrower anterior portion of the micropylar plate.

Variability. – The wild ♀ in the authors collection (FH No. 1263-4, Fig. 23E) is remarkable for having an additional conical spine in the posterior half of the outer carinae of the mesonotal triangular area, the triangular posterior mesal of the abdominal terga strongly developed and almost as large as the posteriors of the corresponding terga, a small spine at the posterolateral angle of terga II-V and having a distinct spinose pair of posteriors also on terga VI and VII. Body lengths ♀ 48.0-52.0 mm, ♂ 34.5-37.5 mm.

Remarks. – In the past there has been some discrepancy regarding to the type-locality of this species. Rehn & Rehn (1939: 469) originally described *Hoploclonia hystrix* from a ♂ and immature ♀ for which they stated the locality to be "Sibulan, Oriental Negros, Negros, Philippines. (Baker)". Based on this published information Lit & Eusebio (2005: 209) and Lit (2010: 331) regarded *hystrix* as to be from the island of Negros. However, the original locality label attached to the two type specimens in USNM states "Island Sibuyan, Baker", thus it is clear that the specimens actually originate from the island of Sibuyan and not from Negros. This is supported by further specimens of *hystrix* that have recently become available for examination, all of which are from Sibuyan. Illustrations of the eggs were presented by Hennemann *et al.* (2016: 134, Fig. 70a-c). Unfortunately, the examined example in the collection of O. Zompro (Berlin) could not be re-examined for providing a proper description as well as photographs and no eggs were saved from the culture stock. From the known eggs of the genus, this egg most closely resembles that of *T. napalaki* **n**. **sp**. Detailed illustrations of both sexes and a photographic documentation are here provided. The ♀ was only described from an immature by Rehn & Rehn (1939: 471), but since the morphology of the adult insect essentially corresponds to that of large immatures no redescription but only detailed illustrations of the adult ♀ are presented herein.
A culture was maintained for a few generations that was given rise by specimens collected near San Fernando, Romblon, Mount Guiting Nature Park on the island of Sibuyan in June 2014 by Albert Kang (Singapore). Meanwhile the culture has vanished and it has not been given a Phasmid Study Group culture number.

Distribution. – Sibuyan (unspecified [USNM – type locality, FH, RBINS]; Romblon, San Fernando, Mount Guiting Nature Park [FH; photographic record by Albert Kang: https://www.jungledragon.com/image/50821/spiny_phasmid_couple.html and https://inaturalist.ca/observations/62277997]).

Tisamenus irenoliti **n**. **sp**.

(Fig. 25-26)

ZooBank: https://zoobank.org/547D2412-D268-45D1-B07D-DBBEA288EA56

HT, ♀: Coll.R.I.Sc.N.B., Coll.I.R.Sc.N.B., Philippines, Marinduque, 2010, local collector [RBINS].

PT, ♂: Coll.I.R.Sc.N.B., Philippines, Marinduque, 2010, local collector [RBINS].

PT, ♂: Coll.R.I.Sc.N.B., Philippines, Marinduque, II.2014, local collector, I. Lumawig [RBINS].

PT, ♀ (penultimate instar): Philippinen, Marinduque Island, Boac Municipality, Cawit, leg. Eric Oria III.2009 [FH, No. 1518-1].

Differentiation. – This species most closely resembles *T. lachesis* (Rehn & Rehn, 1939) and *T. polillo* (Rehn & Rehn, 1939) but is only known from the island of Marinduque, whereas the other two species are distributed on Luzon and the Polillo Islands. The ♂ is easily separable from *lachesis* by the much smaller size (body length in *lachesis* > 42.5 mm), slightly stockier overall shape (Fig. 26A-D), more trapezoidal and gradually broadening mesothorax, lack of an enlarged anterior spine on the two carinae of the triangular mesonotal area, notably more incrassate metafemora and more numerous, distinct and acute ventral teeth of the metatibiae (Fig. 26E). From *polillo* this ♂ is readily distinguished by the much more pronounced meso- and metapleural spines, conically raised posterior portion of the meso- and metanotum (Fig. 26C, I, J) which bears a low pair of inter-posterior meso- and metanotals, smaller triangular area of the mesonotum, which covers notably less than half the length of this segment, more incrassate metafemora (Fig. 26E) and distinct, triangular ventral teeth of the metatibiae (only 2-3 small dentate nodes in *polillo*). The ♀ differs from that of *lachesis* by the having the anterolateral mesopleural much smaller than the following and rather sub-obsolete (distinct and spinose in *lachesis*), the arched margins of the triangular mesonotal area, which lacks an anterior spine (more or less straight and with a spinose anterolateral projection in *lachesis*), more distinct praeopercular organ (Fig. 25G), more broadly and evenly rounded posterior margin of the anal segment (Fig. 25F), as well as the larger teeth of the posterodorsal carina of the profemora and more distinctly dentate ventral carinae of the metatibiae. From *polillo* this ♀ is distinguishable by the slightly stockier form, having four instead of three mesopleural laterals, shorter triangular mesonotal area that does not attain the middle of the segment (Fig. 25H; notably more than half as long as mesonotum in *polillo*), lack of the anterolateral spinose projection of the carinae of that area seen in *polillo*, presence of two distinct metapleurals (lacking in *polillo*), larger teeth of the posterodorsal carina of the profemora and more distinctly dentate ventral carinae of the metatibiae. Moreover, the ♀ holotype of *irenoliti* **n**. **sp**. readily differs from both species by the remarkably blunt and peg-like, not truly spinose meso- and metapleural laterals, and generally less pointed elements of head and body armature, but as stated below this might be an individual trait of the holotype with these elements of thoracic armature actually showing noteworthy intraspecific variability.

Etymology. – This new species is named after Ireno L. Lit jr., assistant professor at the Department of Forest Biological Sciences and entomological curator at the UPLB, Los Baños, Philippines, for his efforts in the biodiversity study of Philippine Phasmatodea among which, he has described three species of *Tisamenus* and also presented a list of species in the genus (Lit & Eusebio, 2010).

Description

♀ (Fig. 25)

Form and colouration. – Size average for the genus (body length 54.7 mm); general form moderately slender and elongate, legs slender and with distinct armature; elements of armature moderately developed with the meso- and metapleural spines in the unique holotype remarkably blunt and rather peg-like than spinose, which is unique within the genus but may underlie intraspecific variability as an immature ♀ suggest (see remarks below). General colour of the holotype (Fig. 25A-D) varying from mid to dark brown to drab with the raised medio-longitudinal keel of meso- and metanotum orangey ochre; mesosternum greyish buff, the metasternum rather chestnut brown with the lateral longitudinal carinae of mesonotum marked by three washed dark grey spots. Limbs unevenly flecked with ochre. Antennae drab with the terminal five joints yellow to buff.

Head. – Rectangular, longer than wide with the genae roughly parallel-sided and almost 1.3x longer than wide. Frons with an obtuse swelling between the eyes. Supra-orbitals moderately prominent, bluntly conical and with a small, tubercle anteriorly and posteriorly; occipitals low and obtusely conical; lateral and median coronals rather small, tubercular and more acute than occipitals. Genae with a gular ridge that is supplied with a about three obtuse nodes and some scattered granules in lower portion (Fig. 25H). Eyes fairly small, almost hemispherical and their diameter corresponding to scarcely more than half the length of gena. Antennae comparatively long and slender, with all joints except IV and V notably longer than wide and consisting of 26 joints; scapus weakly trapezoidal in dorsal aspect with interior carina rounded apically, pedicellus a little more than half as long as scapus and almost cylindrical; III slightly longer than pedicellus, IV much shorter and

Fig. **24**. *Tisamenus hystrix* (Rehn & Rehn, 1939) ♂.

A. Dorsal view of HT [USNM © Paul D. Brock]. **B**. Dorsolateral view [USNM © Paul D. Brock]. **C**. Ventral view [USNM © Paul D. Brock]. **D**. Dorsal view [FH 1263-2]. **E**. Dorsolateral view [FH 1263-2]. **F**. Anteroventral view of left hind leg [FH 1263-2]. **G**. Closeup of head, pro- and mesonotum [FH 1263-2. **H**. Terminalia in lateral view [FH 1263-5]. **I**. Terminalia in dorsal view [FH 1263-5]. **J**. Terminalia in ventral view [FH 1263-5]. **K**. Live couple San Fernando, Romblon, Mount Guiting Natural Park, Sibuyan [© Albert Kang https://inaturalist.ca/observations/62277997]

joints up to XII slightly increasing in length, then somewhat gradually decreasing with the terminal antennomere elongated and almost as long as preceding two joints taken together. Scapus and pedicellus each with an ochre, extero-basal swelling.

Thorax. – Pronotum rectangular; triangular area narrow and quite well indicated with margins tubercular and anterolaterally with a fairly strong but bluntly conical bifid spine (Fig. 25H), pre-sulcal area somewhat gibbose; posterior pronotals low, conical. Mesothorax gradually widening towards the posterior and 2.45x longer than prothorax with posterior portion some 1.3x wider than anterior margin. Mesonotum sub-rectangular with a gentle median constriction and almost 2.1x longer than width at anterior margin; triangular area not reaching middle of notum (Fig. 25H), somewhat longer than wide, disk shallowly concave and the margins weakly arched and minutely tuberculate with the anterolateral angles protruded into an only very indistinctly enlarged obtuse tubercle; posterior portion of mesonotum with a distinct and unevenly granular medio-longitudinal bulge, that is faintly indicated in the posterior section of the triangular area by a few low granules; posteromedian portion of mesonotum conically raised and shallowly bi-tuberculate. Mesopleurae notably expanding towards the posterior and armed with four laterals, the antero-lateral small and sub-obsolete, the second to fourth one short but strong, (in the holotype) remarkably blunt, peg-like and roughly uniform in size; mesopleural basically like the three large mesopleurals; supra-coxal small, tubercular. Metanotum somewhat wider than long, with a slight narrowing pre-medially and the antero-lateral portions distinctly lowered; otherwise with the same medio-longitudinal bulge and obtuse, bi-tuberculate pre-posterior swelling seen on mesonotum. Metapleurae with two short and bluntly conical laterals; metapleural larger, tubercular and the supra-coxal angle with a small, obtuse spine that is accompanied by a small tubercle posteriorly. Mesosternum distinctly tri-carinate, the medio-longitudinal carina in particular strongly developed; metasternum with a

shallower medio-longitudinal carina, densely but unevenly granular and with a few faint indications of metasternals laterally (Fig. 25I).

Abdomen. – Median segment transverse with anterior margin broadly rounded, shallowly carinate and granulate medio-longitudinally. Segments II-VII broadly transverse and all terga with a slight trace of two closely spaced medio-longitudinal carinae; II about 2.3x and VII only about 2x wider than long; all gradually narrowing; with VII distinctly trapezoidal in outline. Terga II-VI with second paired posteriors represented by spiniform tubercles, that are most prominent on II and notably decrease in size towards VI; on VII merely represented by low tubercles; postero-lateral small and tubercular. Sterna II-VII destitute of any noteworthy armature; praeopercular organ on VII formed by a somewhat raised posterior margin in the median portion, that bears a low, transverse tubercular swelling at each lateral end (Fig. 25G). Tergum IX obtusely tectate bi-carinate medio-longitudinally and with a moderate conical swelling posteromedially (Fig. 25E); at anterior margin supplied with four nodose anteriors (Fig. 25F). Anal segment strongly declining with the lateral margins very obliquely convergent in posterior half and with a fairly well developed medio-longitudinal carina; close to anterior margin with two pairs of nodes and posterior margin very broadly rounded (Fig. 25F). Epiproct shallowly tectate longitudinally with an indication of a medio-longitudinal carina, the lateral margins weakly and obliquely convergent and the posterior margin rounded with a small median swelling (Fig. 25F). Subgenital plate fairly elongate, notably projecting beyond epiproct, navicular, distinctly carinate in posterior half and the apex narrowly triangular and acute (Fig. 25G).

Legs. – All slender and elongate for the genus; the femoral teeth comparatively small but pointed and the ventral teeth more pronounced than dorsal ones. Profemora as long as mesothorax, metafemora reaching about one-third the way along abdominal segment V and metatibiae slightly projecting beyond tip of abdomen. Posterodorsal carina of profemora with five distinct and acute spiniform teeth in basal half; the one or two apical teeth much smaller to sub-obsolete. Dorsal carinae of meso- and metafemora with seven teeth, the two outer ventral carinae of mesofemora with five teeth that notably decrease towards base of femur; in metafemora these teeth are all comparatively more pronounced and the large apical one is accompanied by a second much smaller tooth. Metatibiae smooth dorsally and with 8-10 unequally sized triangular teeth ventrally. Tarsi comparatively long; basitarsi almost as long as following three tarsomeres combined.

Measurements of holotype [mm]. – Body 54.7, pronotum 4.1, mesonotum 10.9, metanotum 5.2, median segment 2.8, profemora 10.7, mesofemora 9.6, metafemora 12.8, protibiae 10.8, mesotibiae 9.7, metatibiae 14.1, antennae 20.4.

♂ (Fig. 26)

Form and colouration. – Size rather small for the genus (body length 39.0 mm); general form slender and elongate, legs fairly strong with the metafemora strongly incrassate; elements of armature moderately developed with short but strong meso- and metapleural spines and a distinct conical posteromedian swelling of meso- and metanotum. General colour mid brown to buff with the raised medio-longitudinal keel of meso- and metanotum and most of abdomen ochre (in one of the paratypes more distinct than in the other); meso- and metasternum straw coloured with the lateral regions exterior to the lateral longitudinal carinae densely flecked with drab. Antennae buff and gradually becoming lighter in colour in their apical one-third.

Head. – Essentially as in ♀. Inter-ocular swelling of frons with a C-shaped, transverse impression behind, which comprises four low granules (Fig. 26J). Genae with gular ridge just shallow and unevenly granular (Fig. 26I-J). Eyes fairly small, hemispherical and their diameter corresponding to scarcely more than 0.4x length of gena. Antennae similar to ♀, but only with 24 joints; the terminal antennomere somewhat more elongated and as long as preceding two joints taken together.

Thorax. – Pronotum essentially as in ♀ rectangular, but the bifid anterior spine of triangular area much larger and acutely pointed with the second spike slightly higher than the anterior one (Fig. 26I-J). Armature of meso- and metathorax more developed and acute than in ♀. Mesothorax elongate, gradually widening towards the posterior and about 2.6x longer than prothorax with posterior portion 1.5x wider than anterior margin. Mesonotum sub-rectangular with a moderate median constriction and about 2.5x longer than width at anterior margin; triangular area not reaching middle of notum (Fig. 26I-J), somewhat longer than wide, disk shallowly concave and the margins minutely tuberculate with the anterolateral angles protruded into a somewhat enlarged obtusely conical tubercle; posterior portion of mesonotum with a distinct and shallowly granulate medio-longitudinal bulge, that is faintly indicated in the triangular area by a few low granules; posteromedian portion of mesonotum strongly conically raised and obtusely bi-tuberculate (notably more pronounced than in ♀, Fig. 26I-J). Mesopleurae notably expanding towards the posterior and armed with four laterals, the antero-lateral small and sub-obsolete, the second to fourth one short but strong, spinose and just weakly sub-uniform in size (size somewhat variable); mesopleural a prominent conical spine; supra-coxal small, tubercular. Metanotum longer than wide with a narrowing pre-medially and the antero-lateral portions distinctly lowered; otherwise with the same medio-longitudinal bulge and conical, bi-tuberculate pre-posterior swelling. Metapleurae with two short and conical laterals; metapleural small, tubercular and the supra-coxal angle with a strong spine that is accompanied by a small tubercle posteriorly. Mesosternum distinctly tri-carinate, anteriorly the lateral carinae are connected by a distinct, widely V-shaped transverse carina; metasternum like in ♀.

Abdomen. – Median segment transverse with anterior margin broadly rounded and shallowly carinate medio-longitudinally. Segment II trapezoidal, III-VII almost uniform in width and very slightly decreasing in length; all sub-quadrate. Terga II-VII with very faintly indicated medio-longitudinal carina; II-IV with low tubercular paired second posteriors (just represented as minute nodes on V-VI). Sterna II-VII with a fine medio-longitudinal carina. Terga VIII and IX with the medio-longitudinal carina much more pronounced than on preceding segment and somewhat raised posteriorly; VIII trapezoidal and widening towards posterior, IX transverse. Anal segment longer than IX, somewhat cucullate in lateral aspect, narrowed posteriorly with the lateral margins angular and the dorsal surface with a fine but low medio-longitudinal carina; posterior margin with a deep, concave median excavation and the outer angles triangular (Fig. 26G). Epiproct distinct, shield-shaped, almost semi-circular in shape and a little projecting beyond anal segment (Fig. 26G). Vomer broad, transverse with a fairly long and strong, terminal hook, that is about 30° dextral-directed. Poculum rather small, roundly cup-shaped (Fig. 26F) with a large and very broad, weakly labiate and angular flange of the free upper margin that is straight posteriorly and reaches slightly less than halfway along anal segment (Fig. 26F, H).

Legs. – All stocky with the femora weakly and the metafemora strongly incrassate; the femoral teeth however comparatively small with the ventral teeth more pronounced than dorsal ones. Profemora slightly longer and mesofemora a little shorter than mesothorax, metafemora reaching to posterior of abdominal segment V and metatibiae almost reaching to tip of abdomen. Ventro-basal swelling of metafemora small but distinct, gibbose and smooth; all four outer carinae with six teeth, those on dorsal carinae weakly increasing in size towards base of femur, the two apical ventral teeth prominent and somewhat spiniform. Metatibiae smooth dorsally and with about eight unequally sized triangular teeth ventrally. Tarsi comparatively long; basitarsi about as long as following three tarsomeres combined.

Measurements of paratypes [mm]. – Body 38.7-39.0, pronotum 3.0, mesonotum 7.6-7.7, metanotum 3.9, median segment 2.1, profemora 7.3-7.5, mesofemora 6.8-7.0, metafemora 8.9-9.3, protibiae 7.7–8.0, mesotibiae 6.7-7.2, metatibiae 8.0-9.0, antennae 15.5-16.7.

Remarks. – The immature ♀ in the author's collection, which appears to be in the penultimate instar, has all the elements of the body armature much more developed than in the adult ♀ holotype, acutely pointed and spinose. This suggests the shape and size of the meso- and metapleurals in particular to underlie considerable intraspecific variability, similar like in e. g. *T. polillo* (Rehn & Rehn, 1939). However, more examples are needed to prove or dismiss this assumption. Egg unknown. Body length of penultimate instar ♀ paratype 45.0 mm.

Distribution. – Marinduque, endemic [RBINS – type locality].

Tisamenus kalahani Lit & Eusebio, 2005

Tisamenus kalahani Lit & Eusebio, 2005: 209, Fig. 1 (♂).

HT, ♂: Luzon Is., Nueva Vizcaya Prov., Imugan, Sta. Fe, 01.v.2005, E.A. Cosico [UPLB, No. PHA-00358].

- Brock & Büscher, 2022: 521.

- Hennemann, 2023b: 128.

Fig. **25**. *Tisamenus irenoliti* **n**. **sp**. ♀ HT [RBINS].

A: Dorsal view.**B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Terminalia in lateral view. **F**. Terminalia in dorsal view. **G**. Terminalia in ventral view. **H**. Closeup of head, pro- and mesonotum. **I**. Closeup of pro-, meso- and metasternum.

Fig. **26**. *Tisamenus irenoliti* **n**. **sp**. ♂ PT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Anteroventral view of right hind leg. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I**. Closeup of head, pro- and mesonotum. **J**. Closeup of head, pro- and mesonotum of PT [FH 1518-1].

Differentiation. – Males of this small and very slender species (the only sex known) are morphologically closest to *T. polillo* (Rehn & Rehn, 1939) and *T. summaleonilae* Lit & Eusebio, 2005. From the first they can be separated by the smaller size and slenderer shape and limbs, simple but very prominent anterior pronotals (tri-spinose in *polillo*), noticeably lower carinae of the triangular mesonotal area, much smaller supra coxal spines, which are only represented as conical tubercles, and lack of paired posterior spines on abdominal terga II-IV. From *summaleonilae* they differ by the much slenderer shape and limbs and having the mesothorax almost uniform in diameter (notably gradually widening towards the posterior in *summaleonilae*), less widened metapleurae, large and closely spaced anterior pronotals but small antero-laterals, as well as the smaller triangular area of the mesonotum, which just slightly projects of the mid of the mesonotum.

Remarks. – Female unknown. Body length ♂ 31.7 mm.

Distribution. – N-Luzon. Province Nueva Vizcaya, Imugan, Santa Fe [UPLB – type locality]).

Tisamenus lachesis (Rehn & Rehn, 1939)

(Fig. 27-30, 46O-P)

Hoploclonia lachesis Rehn & Rehn, 1939: 471.

HT, ♂: Polillo, Taylor; *Hoploclonia lachesis* Rehn & Rehn, Type; Type No. 53314 U.S.N.M. [USNM].

Tisamenus polillo, Zompro, 2004: 206.

- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Tisamenus serratorius, Dräger, 2012: 12, figs. 16-17. (Misidentification)

- Krijns, 2011: 7. (Misidentification – culture report)

Tisamenus sp. „Quezon National Park", Dräger, 2012: 12, figs. 18-22.

Tisamenus sp. „Cunayan", Dräger, 2012: 13.

Material examined

1 ♀: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, V.2014, local collector, I. Lumawig, [RBINS];

1 ♀: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, vi.2014, 16°17'N 122°35'E, Leg. I. Lumawig, gift from B. Kneubühler, I.G.: 32.613 [RBINS];

2 ♂: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, iv.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS];

1 ♀: Coll. R.I.Sc.N.B., Philippines, Luzon, Aurora Prov., Cunayan Falls [RBINS];

20 ♀, **13** ♂, **1** ♀ (penultimate instar), 20 eggs: Ex Zucht: F. Hennemann 2011-2013, Herkunft: Philippinen, Luzon Id., Prov. Quezon, Reál, 2009 [FH, No's 0727-1 to 34, E1];

4 ♀, **1** ♂, **1** ♀ (penultimate instar): Ex Zucht: F. Hennemann 2014/15, Herkunft: Philippinen, Luzon, Prov., Aurora, Cunayan Falls, 2009 (PSG 359) [FH, No's 0727-35 to 40];

5 ♀, **6** ♂, **1** ♀ (immature), **3** eggs: Philippinen, Ost Luzon Island, Provinz Aurora, Sierra Madre, Dingalan, 230 m, local collector X.2012 [FH, No's 0727-41 to 51, E2];

1 ♀, **1**♀ (penultimate instar): Philippinen, S Luzon Id., Bicol Region, Provinz Sorsogon, Mount Bulusan, local collector IX.2012 [FH, No's 0727-52 & 53];

1 ♂: Philippinen, O Luzon Id., Prov. Isabela, Sierra Madre, Cagayan Valley, Palanan, local collector II.2011 [FH, No. 0727-55];

1 ♀, **1** ♂: Philippinen, S-Luzon Id., Provinz Quezon, Sierra madre, Real, local collector II.2012 [FH, No's 0727-58 & 59];

1 ♀, **2** ♂: Philippinen, S-Luzon Id., Provinz Quezon, Calabarzon, General Nakar Munip., collector XII.2012 [FH, No. 0727-60 to 62];

1 ♂: Philippinen, S-Luzon, Provinz Bulacan, Santa Maria Munip., local collector V.2012 [FH, No. 0727-57];

1 ♂, **3** ♀ (immature): Philippinen, Ost Luzon Island, Provinz Aurora, Sierra Madre, Dingalan, 230 m, local collector III.2012 [FH, No's 0727-63 to 66];

4 ♀, **5** ♂, **2** ♀ (immature): Philippinen, Provinz Laguna, Santa Rosa Municipality, local collector VI-VII.2012 [FH, No's 0727-67 to 77];

2 ♀ (penultimate instar): Philippinen, Provinz Nueva Vizcaya, Santa Fe Munip., Canabuan, local collector XI.2012 [FH, No's 0727-78 to 79];

1 ♀: Philippinen, Eastern Visayas, Provinz Northern Samar, Samar Island, Lope de Vega, local collector III.2012 [FH, No's 0727-56].

Differentiation. – Females of this widely distributed Luzonian species (Fig. 27) are morphologically closest to those of *T. polillo* (Rehn & Rehn, 1939), which seems to be sympatric at several of the known localities including Polillo Island, the type-locality of both species, as well as *T. serratorius* Stål, 1875. These ♀ can however easily be separated from those of *polillo* by on average larger size, always having five distinct spines along the lateral margins of the mesopleurae (only three in *polillo*, of which only the mesopleural is frequently spinose with the other spines often only represented as tubercles), presence of 1-2 distinct metapleural laterals (none in *polillo*), presence of more or less distinct paired inter-posterior meso- and metanotals (Fig. 27G, J and 28G-H), which however may occasionally only be represented as conical tubercles (wholly wanting in *polillo*), strongly raised and spinose anterior angle of the carinae of the triangular mesonotal area (Fig. 28F-H; just weakly protruded in *polillo*) and presence of second paired posterior spines on abdominal tergum V. From *serratorius* these ♀ differ by the much larger size (body length > 57.0 mm), relatively longer mesonotum, smaller triangular mesonotal area, which is no more than half as long as the mesonotum (Fig. 28F-H), having only five strong mesopleural spines (six distinct spines in *serratorius*), notably more developed and spinose cephalic armature and body spination, and longer subgenital plate, that notably projects beyond the tip of the epiproct (Fig. 28A-E). Males (Fig. 29A-G) show the closest morphological affinity to those of *polillo*, but can be distinguished by the stockier overall shape and limbs, always having five strong mesopleural spines (at best four spines in *polillo* of which only the mesopleural is frequently spinose), presence of distinct metapleural laterals, presence of paired inter-posterior meso- and metanotals (Fig. 29N-O), strongly protruded and more or less spinose anterior angle of the carinae of the triangular mesonotal area (Fig. 29N-O; just weakly raised in *polillo*) and more acute medio-longitudinal carina of the mesosternum (Fig. 29P). These ♂ also strongly resemble those of *serratorius* but are larger (body length > 41.0 mm) and considerably slenderer and can readily be separated by having only five instead of six mesopleural spines and having the triangular mesonotal area extending not further than to the middle of the segment. From the essentially similar but smaller and much stockier *T. clotho* (Rehn & Rehn, 1939) both sexes of *lachesis* are readily distinguishable by the relatively longer body segments, less widened meso- and metapleurae and shorter pleural spines, as well as the more elongate mesonotal triangular area, which is notably longer than wide (about as long as wide across the anterolateral angles and roughly forming an isosceles triangle in *clotho*). The eggs (Fig. 46O-P) differ from all other known eggs of congenerics by the more elongate shape being as much as 1.7x longer than wide, very dense and rather uniform meshwork of densely setose ridges and short posterior lobes of the micropylar plate, which do not extend to the middle axis of the capsule. The short posterior extensions are shared with eggs of *T. hebardi* (Rehn & Rehn, 1939) but in that species the extensions are even shorter and only form two rounded lobes.

Description

♀ (Fig. 27)

Form and colouration. – Size variable but large for the genus (body length 57.0-70.0 mm); general form quite slender and elongate; the elements of armature strongly developed and mostly spinose; legs elongate and slender with weakly developed armature. Body surface unevenly granular. General colour mostly ranging from fairly plain drab over various tones of brown and fuscous to almost black, but also clay coloured to ochraceous specimens occur

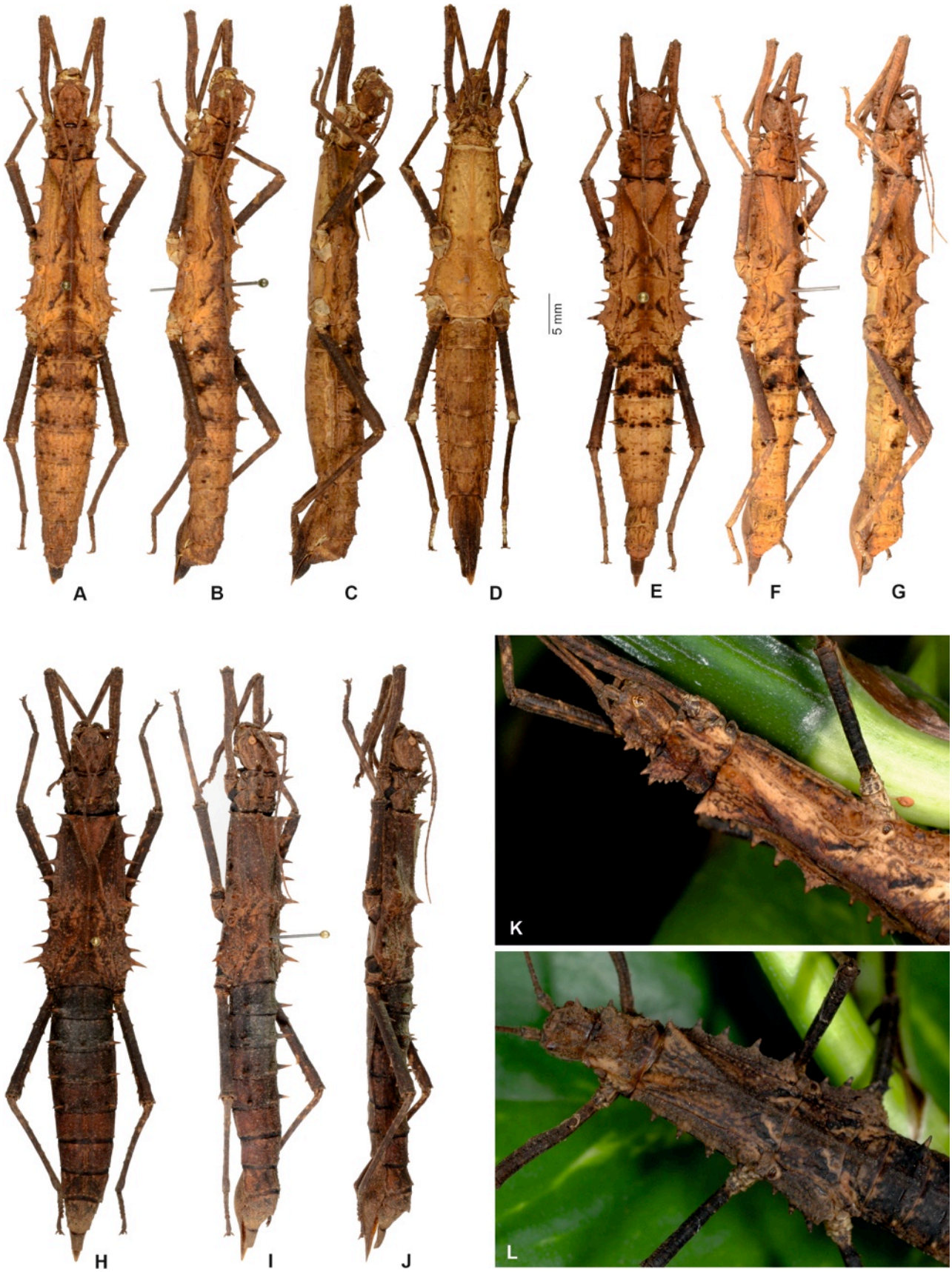

Fig. **27**. *Tisamenus lachesis* (Rehn & Rehn, 1939) ♀.

A. Dorsal view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **B**. Dorsolateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **C**. Lateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **D**. Ventral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **E**. Dorsal view (captive reared from Cunayan, Aurora Province, Luzon) [FH 0727-36]. **F**. Dorsolateral view (captive reared from Cunayan, Aurora Province, Luzon) [FH 0727-36]. **G**. Lateral view (captive reared from Cunayan, Aurora Province, Luzon) [FH 0727-36]. **H**. Dorsal view (from Dingalan, Aurora Province, E-Luzon) [FH 0727-54]. **I**. Dorsolateral view (from Dingalan, Aurora Province, E-Luzon) [FH 0727-54]. **J**. Lateral view (from Dingalan, Aurora Province, E-Luzon) [FH 0727-54]. **K**. Closeup of head, pro- and mesonotum of light brown live captive reared ♀ from Real, Quezon Province, Luzon, dorsolateral view. **L**. Closeup of head, pro- and mesonotum of live dark brown captive reared ♀ from Real, Quezon Province, Luzon, dorsal view.

that have distinct black V-shaped posterior markings on the meso- and metanotum and black spots in front of the second paired posteriors of abdominal terga II-IV (Fig. 27A, E); often the area along medio-longitudinal keel of meso- and metanotum dark brown in the lighter specimens (Fig. 27K). Meso- and metasternum lighter in colour and buff to almost clay coloured (Fig. 27D). Femora mostly mid to dark brown and almost black, usually darker than body. Largest spines of head and body with apical half dark orange. Antennae with terminal five joints ochre to dark orange.

Head. – Basically, as in ♂; somewhat longer than wide, the eyes much smaller, sub-globose and their diameter corresponding to a little less than 0.4x the length of gena. Armature essentially as in ♂, but coronals less than half as large as the spinose supra-orbitals; the occipitals smaller than coronals, conically tubercular (Fig. 28F-H). Antennae almost reaching to tip of front legs and consisting of 26 joints; scapus and pedicellus like in ♂, the terminal joint almost as long as two preceding ones combined.

Thorax. – Pronotum like in ♂; the strong anteriors however basically trifid and ranging from tubercular to strongly spinose with the anterior spike anteriorly projecting over anterior margin of pronotum (Fig. 28F-H), but occasionally with an additional spike posteriorly (Fig. 28H) or with single, much smaller intercalated points. Like in ♂, the transverse median sulcus notably shifted towards the posterior. Mesothorax narrowed anteriorly and very slightly widening towards posterior; 2.6x longer than prothorax and 1.4x longer than prothorax and posterior portion 1.3x wider than anterior margin. Mesonotum elongate, slightly convergent towards the posterior and with a small narrowing one-quarter before posterior margin and 2x longer than width at anterior margin; triangular area shorter than in ♂, scarcely attaining middle of segment and roughly an isosceles triangle, the convergent margins granular and becoming slightly tubercular towards the tubercular to spinose anterolateral angle (Fig. 28F-H). Posterior half of mesonotum with a distinct, granular medio-longitudinal keel that is weakly indicated in the triangular area; inter-posteriors variable in size and ranging from low, sub-obsolete tubercles to distinct spines. Mesopleurae moderately expanding towards posterior and like in ♂ with three strong, slender and long spinose laterals, the anterior one of which is notably smaller than the three following ones; mesopleural large, spinose, notably larger than laterals and occasionally with a few small tubercles around the base. Metanotum weakly sub-trapeziform; the medio-longitudinal keel and inter-posteriors like on mesonotum. Metapleurae like in ♂ with two spinose laterals and a very strong, spinose supra-coxal at the moderately expanded angle; metapleural small, tubercular. Mesosternum distinctly tri-carinate and destitute of mesosternals (Fig. 28I). Metasternum only with a weakly indicated medio-longitudinal carina (Fig. 27D).

Abdomen. – Median segment distinctly trapezoidal with anterior margin rounded; the medio-longitudinal carina shallow and marked by clustered granules; occasionally with a transverse row of four small nodes at posterior margin. Segments II-VII scarcely sub-equal in length; II-III weakly increasing and V-X almost gradually and notably decreasing in width; II-VII transverse with V about 2x wider than long. All terga with two fine and closely spaced, parallel medio-longitudinal carinae which are just faintly indicated on II-IV but rather definite on following; II-V with a more or less prominent second-paired posterior spines and a variably sized posterior mesal, that varies from tubercular to distinctly spinose but is always smaller than the second-paired posteriors. Sterna II-VII with a fine medio-longitudinal carina; praeopercular organ formed by a two shallow, converging bulges that posteriorly terminate in a small swelling. Tergum VIII trapezoidal in dorsal view, IX obtusely tectate with an obtuse, triangular posteromedian protrusion formed by the two medio-longitudinal carinae (Fig. 28A-B). Anal segment strongly declining with the lateral margins obliquely convergent in posterior half and with a fairly well developed medio-longitudinal carina; close two anterior margin with a pair of nodes and posterior margin broadly rounded (Fig. 28A-D). Epiproct weakly tectate longitudinally with an indication of a medio-longitudinal carina, the lateral margins weakly convergent and the posterior margin roundly angular (Fig. 28C-D). Subgenital plate fairly elongate, notably projecting beyond epiproct, navicular, distinctly carinate in posterior half with the apex narrowly triangular (Fig. 28E).

Legs. – All slender and elongate with the teeth rather weakly developed but all acutely triangular; the two apical ventral teeth of meso- and metafemora rather spinose and those of the metafemora the largest of all teeth. Profemora roughly equal in length to mesothorax, mesofemora notably shorter; metafemora reaching to posterior margin of abdominal segment V and metatibiae almost reaching to tip of epiproct. Pro- and mesotibiae wholly unarmed, metatibiae only with 5-7 small denticles or indications of teeth on two ventral carinae. Basitarsi rather elongate, almost as long as following three tarsomeres taken together.

Measurements [mm]. – Body 57.0-70.0, pronotum 4.5-5.0, mesonotum 10.3-13.0, metanotum 4.7-5.8, median segment 2.4-2.8, profemora 10.3-12.5, mesofemora 9.2-11.5, metafemora 12.0-14.8, protibiae 10.2-12.0, mesotibiae 9.1-11.2, metatibiae 12.3-15.4, antennae 19.5-21.0.

Variability. – Both sexes of this species show considerable intraspecific variability in size, armature of the head and body and also some variability is seen in the colouration. While the morphological traits show a certain degree of affiliation to individual populations, the chromatic variation appears to be not much correlative to the distribution. It seems only noteworthy that light clay coloured to ochraceous ♀ with distinct black V-shaped posterior markings on the meso- and metanotum and black spots in front of the second paired posteriors of abdominal terga II-IV are predominantly found in the population at Cunayan Falls, Province Aurora (Fig. 27A-B, E-F). These are also found among specimens from other localities but relatively much lesser in number. While ♂ are more constant in colour and mostly varying from dark buff over sepia and umber to dark brown, often with a slight orangey wash, ♀ show more variability in colour. Aside from the colour morph described above, the majority of specimens is rather plain drab to fuscous (Fig. 27 H-J) or even almost black. In the lighter coloured specimens, the femora are contrastive dark brown and usually these are darker than the body.

All elements of cephalic, thoracic and abdominal armature are subject to variability and vary in size. The elements with the most noteworthy variability are the pronotal anteriors, antero-laterals of the triangular mesonotal area, inter-posteriors of the meso- and metanotum and medial of abdominal terga II-V. The latter are sub-obsolete or merely represented as small tubercles in most of the ♀ examined but developed to short but distinct spines in the examples from Cunayan Falls and some of the specimens from Dingalan, Province Aurora. All ♂ from Palanan, Province Isabela, Cunayan Falls and Dingalan possess a prominent pair of spinose inter-posterior meso- and metanotals (Fig. 27F-G and I-J, 29F-G). These are comparatively smaller and rather tubercular in the examples from Santa Rosa, Province Laguna, whereas they are sub-obsolete and merely seen as small tubercles in specimens from other localities (e. g. Fig. 27C, 29C). The population from Dingalan is interesting in that three of the five ♀ at hand have these mesonotal and metanotal inter-posteriors well developed and sub-spinose, whereas they are sub-obsolete to almost complete missing in the other two specimens. The antero-lateral mesonotals at the anterior angles of the triangular area vary from obtusely tubercular (e. g. Fig. 28F) to long and acutely spinose (Fig. 28G-H, 29O), generally being most developed in the populations at Dingalan and Santa Rosa. The anterior pronotals are prominent and basically trifid in all ♀ at hand, but vary considerably in size and occasionally have an additional but smaller posterior spike (Fig. 28G-H). The length of the individual tubercles or spines varies from almost uniform to distinctly unequal. In ♂ the pronotal anteriors are always very long and spinose but either bi- or trifid. The ♂ from Santa Maria, Province Bulacan (FH, No. 0727-57) is remarkable for having the mesopleural laterals much smaller than all other examined specimens. Since only this unique specimen is available from this particular locality, it is not possible to decide whether this trait is typical for this population or merely individual.

A remarkable range is also seen in the size of this species, that varies between different populations. The holotype ♂ from the island of Polillo is larger than all other examined specimens with a body length of 51.0 mm. For summarizing the size ranges, body lengths are given here for some of the populations and are as follows: Province Quezon (Real) ♀ 59.0-70.0 mm, ♂ 42.5-48.0 mm; Province Aurora (Cunayan) ♀ 57.0-60.0 mm, ♂ 44.5 mm; Province Aurora (Dingalan) ♀ 61.5-67.0 mm, ♂ 41.5-43.0 mm; Samar (Lope de Vega) ♀ 60.0 mm. A full set of the size range of ♂ is given below.

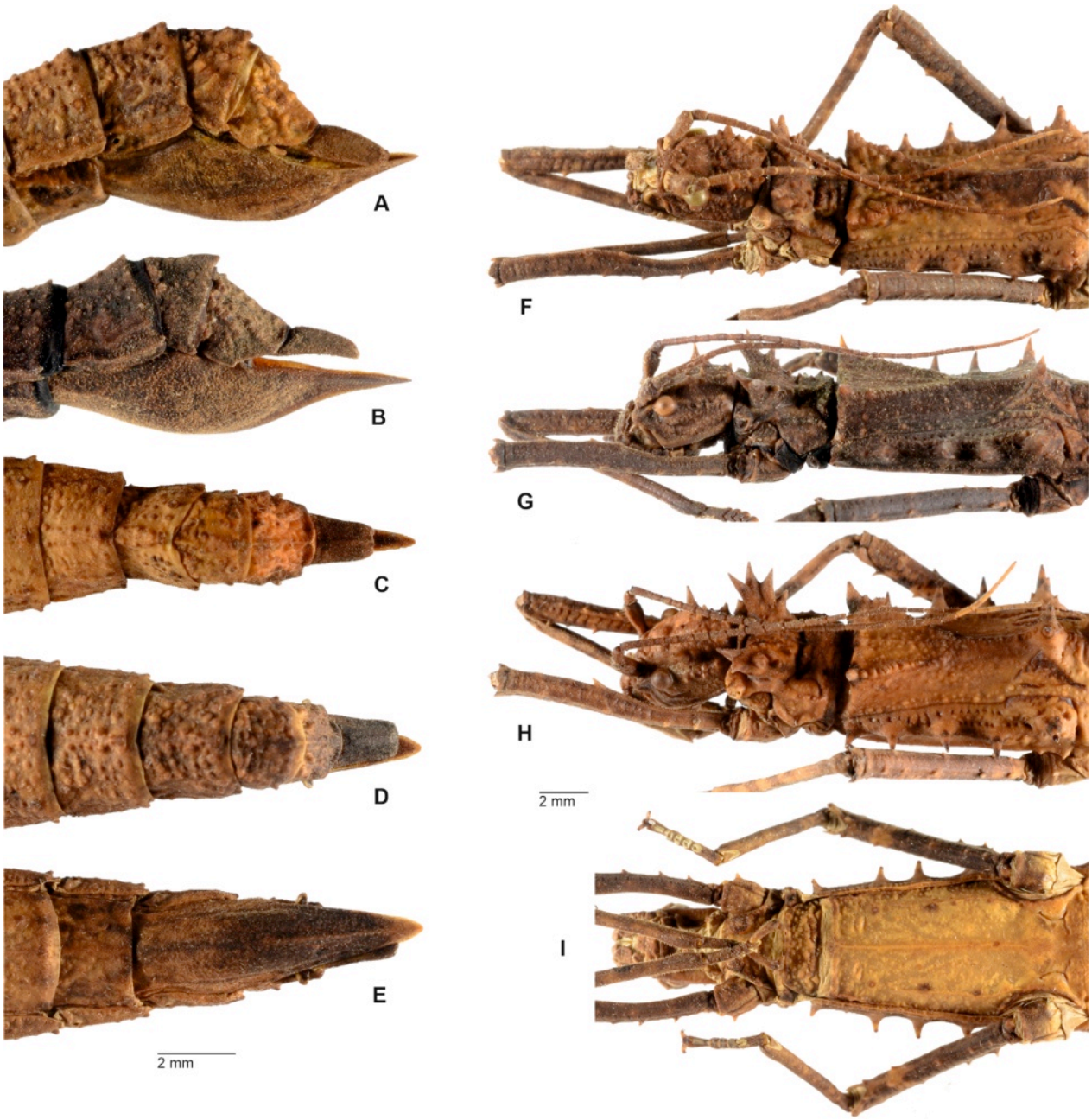

Fig. **28**. *Tisamenus lachesis* (Rehn & Rehn, 1939) details of ♀

A. Terminalia in lateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **B**. Terminalia in lateral view (from Dingalan, Aurora Province, E-Luzon) [FH 0727-54]. **C**. Terminalia in dorsal view (captive reared Cunayan, Aurora Province, Luzon) [FH 0727-36]. **D**. Terminalia in dorsal view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **E**. Terminalia in ventral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **F**. Closeup of head, pro- and mesonotum (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8]. **G**. Closeup of head, pro- and mesonotum (from Dingalan, Aurora Province, E-Luzon) [FH 0727-54]. **H**. Closeup of head, pro- and mesonotum (captive reared from Cunayan, Aurora Province, Luzon) [FH 0727-36]. **I**. Closeup of head, pro- and mesosternum (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-8].

Measurements [mm]. – Body 41.5-51.0, pronotum 3.0-3.5, mesonotum 8.5-10.0, metanotum 3.8-4.2, median segment 2.2-2.5, profemora 8.7-9.8, mesofemora 8.0-8.5, metafemora 9.4-10.6, protibiae 9.1-10.0, mesotibiae 8.0-8.7, metatibiae 10.3-10.9, antennae 16.5-18.0.

Egg (Fig. 46O-P)

Large and rather elongate for the genus; capsule ovoid, slightly oval in cross-section with the lateral surfaces almost parallel-sided in median portion, higher than wide with dorsal surface not noticeably bulgier than ventral surface, the polar-area weakly indented; capsule 1.6x longer than wide. Surface all over covered by fairly long fringy to hairy structures, that are arranged in an irregular and moderately dense meshwork; the fringes only wanting on a moderately broad rim just below anterior margin; that margin also covered by these excrescences. Micropylar plate fairly large and almost 0.8x the length of capsule; Y-shaped with the median portion roughly parallel-sided and almost approaching anterior margin of capsule, the two posterolateral extensions slender and variable in length, either not reaching axis of egg capsule or in the examples from Dingalan (coll. FH 0727-E2) slightly surpassing the axis if seen laterally. Posterior portion 90° V-shaped and with a small and shallow bowl-shaped micropylar cup in centre. Outer margin of plate marked by a rim of fringy excrescences, the inner portion sculptured like capsule and the rim in between outer margin and the slightly raised interior portion smooth and somewhat lowered. Operculum roundly conical, with an outer collar of fringy excrescences and in ventral portion with a broad rim of somewhat longer fringy to hairy structures. Colour plain brown with all the fringes of the capsule, micropylar plate and operculum dark ochre to buff. Measurements [mm]: Length incl. operculum 4.7, length 4.4, width 2.8, height 3.0, length of micropylar plate 3.5.

Fig. **29**. *Tisamenus lachesis* (Rehn & Rehn, 1939) ♂.

A. Dorsal view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18]. **B**. Dorsolateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18]. **C**. Lateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18]. **D**. Ventral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18]. **E**. Dorsal view (from Palanan, Cagayan Valley, Isabela Province, Luzon) [FH 0727-55]. **F**. Dorsolateral view (from Palanan, Cagayan Valley, Isabela Province, Luzon) [FH 0727-55]. **G**. Lateral view (from Palanan, Cagayan Valley, Isabela Province, Luzon) [FH 0727-55]. **H**. Terminalia in lateral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH]. **I**. Terminalia in lateral view (from Dingalan, Aurora Province, E-Luzon) [FH]. **J**. Terminalia in dorsal view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH]. **K**. Terminalia in dorsal view (Dingalan, Aurora Province, E-Luzon) [FH]. **L**. Terminalia in ventral view (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH]. **M**. Anteroventral view of right hind leg (from Palanan, Cagayan Valley, Isabela Province, Luzon) [FH 0727-55]. **N**. Closeup of head, pro- and mesonotum (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18]. **O**. Closeup of head, pro- and mesonotum (captive reared from Cunayan, Aurora Province, Luzon) [FH 0727-18]. **P**. Closeup of head, pro- and mesosternum (captive reared from Real, Sierra Madre, Quezon Province, Luzon) [FH 0727-18].

Remarks. – This species was originally described from a unique ♂ from the island of Polillo in the collection of ANSP and since a detailed description of the ♂ was presented by Rehn & Rehn (1939: 471), intraspecific variability is summarised above and the elements of armature essentially agree between the sexes, only a description of the previously unknown ♀ is presented herein. The eggs are formally described for the first time. At several known localities this species is sympatric with *T. polillo* (Rehn & Rehn, 1939).
Several stocks of *T. lachesis* from different localities are or have been cultured in Europe. A first stock was collected in the village Real and close to Real in the Sierra Madre mountains, Quezon province, South Luzon in 2009 by Joachim Bresseel (RBINS) and Thierry Heitzmann (Philippines) and was the first stock of a *Tisamenus*-species to be introduced to Europe. Further specimens were found with additional stock introduced to Europe by Joachim Bresseel (RBINS), Rob Krijns (Maastricht, Netherlands) and Tim Bollens (Herselt, Belgium) in 2010 (Dräger, 2012: 12). This stock has been referred to as either *Tisamenus* sp. 'Sierra Madre' or *Tisamenus* sp. 'Real' was misidentified as *T. serratorius* and subsequently given the Phasmid Study Group culture No. 314. Already in November 2008 however, Thierry Heitzmann (Philippines) collected a ♀ at Atimona, Quezon National Park, which is about 70 km away from Real (Dräger, 2012: 12) and reared a stock in captivity. Stock that is offspring from this ♀ and exported to Europe has been distributed as *Tisamenus* sp. 'Quezon' or *T. serratorius* 'QNP' and seems to be still maintained by some breeders although. It has however, not been given a PSG culture number (personal communication with Holger Dräger in January 2025). A third stock was collected at the Cunayan Falls, San Luis, Aurora Province. This was distributed as *Tisamenus* sp. 'Cunayan' and given culture No. 359 by the Phasmid Study Group. It seems, that only the first two stocks from Sierra Madre are still maintained in culture, while the Cunayan stock was lost after a few generations. This species has proven very easy and it has become very popular among European breeders because of the pretty colour variations.

Distribution. – Polillo [USNM – type locality]). Luzon: Province Quirino (Sierra Madre [RBINS]); Province Aurora (San Luis, Cunayan Falls [RBINS, FH]; Sierra Madre, Dingalan 230 m [FH]); Province Isabela (Sierra Madre, Cagayan Valley, Palanan [FH]); Province Quezon (Sierra Madre, Real [FH; photographic records by Albert Kang: https://inaturalist.ca/observations/57611953 and Gernot Kunz: https://inaturalist.ca/observations/24796645]; Sierra Madre, Real, Marikina-Infanta highway [photographic record: https://inaturalist.ca/observations/53592446]; Sierra Madre, Atimona [stock collected by T. Heitzmann in 2008]; Province Nueva Vizcaya (Santa Fe, Canabuan [FH]); Province General Nakar [FH]); Province Sorsogon (Mount Bulusan [FH]); Province Bulacan (Santa Maria [FH]); Province Laguna (Santa Rosa [FH]; Siniloan-Famy [photo by Albert Kang: https://www.jungledragon.com/image/47185/stick_insect_phasmid_-_tisamenus_serratorius.html]). Samar: Province North Samar (Lope de Vega [FH]).

Tisamenus makinis n. sp.

(Fig. 31)

ZooBank: https://zoobank.org/225C1EEB-F9E8-469B-AE0F-C08C2875939D

HT, ♂: Coll.R.I.Sc.N.B., Philippines, E. Luzon, Isabela, Didin, IX.2014, local collector, I. Lumawig [RBINS].

Differentiation. – The ♂ of this new species (the only sex known) is easily recognised by the wholly reduced body armature, which readily separates it from all other congenerics. Moreover, it is remarkable for also having the leg armature almost completely reduced and the triangular mesonotal area notably raised but with its outer carinae very weakly developed, shallow and hardly discernible. The reduced body armature is shared with *T. kalahani* Lit & Eusebio, 2005 from Nueva Vizcaya province, but the present species differs by the much stockier overall shape and lacking the large anterior pronotals seen in *kalahani* as well as having the carinae of the triangular mesonotal area much less obvious.

Etymology. – The name (*makinis* Filipino = smooth) refers to the remarkably reduced body armature of this slender and smooth species.

Description

♂ (Fig. 31)

Form and colouration. – Size small (body length 30.8 mm); general form relatively slender and elongate, legs slender; cephalic armature weakly developed (Fig. 31D) and body armature almost wholly reduced. Meso- and metathorax gradually widening towards posterior and together forming a sub-trapeziform unit; body surface minutely and unevenly coriaceous, rugulose or shallowly granular; dorsal keels of thorax, thoracic sterna and the limbs unusually setose. General colour uniformly fuscous, the tarsi faintly orangey. Antennae except for scapus and pedicellus missing in the unique holotype.

Head. – Rectangular, a little longer than wide with the genae parallel-sided. Supra-orbitals small, conical and tubercular; occipitals sub-obsolete and coronals very low, rounded tuberculate; gulars practically missing (Fig. 31D). Frons with a shallow bilobate swelling between the eyes. Eyes of average size, slightly oval in outline, moderately globose and their diameter corresponding to scarcely less than half the length of gena. Scapus elongate, triangular and notably narrowing towards base; pedicellus less than half as long, round in cross-section and somewhat constricting towards apex.

Thorax. – Pronotum slightly sub-trapeziform; triangular area very faintly indicated, anterior pronotals merely represented as low nodes close to anterior margin; transverse median sulcus distinctly indented and almost straight (Fig. 31D). Mesothorax distinctly gradually widening towards posterior, about 2x longer than prothorax and with posterior portion 1.5x wider than anterior margin. Mesonotum elongate, trapezoidal with lateral margins distinctly convergent towards the posterior and with a gentle narrowing pre-posteriorly; about 2.1x longer than width at anterior margin and the anterior margin 1.3x wider than posterior margin. Triangular area strongly raised, very large and covering almost three-quarter of the length of notum, elongate and >2x longer than width across anterolateral angles; disk very shallowly concave and the straight, converging outer margins densely setose (Fig. 31D). Posterior portion of mesonotum with a bold, setose medio-longitudinal bulge, that is very faintly indicated in the posterior half of triangular area. Mesopleurae gradually expanding towards the posterior and unarmed with only the mesopleural weakly indicated as a small, slightly conical node. Metanotum notably longer than wide with a distinct pre-medial narrowing in the anterolateral portions distinctly indented; the medio-longitudinal bulge prominent, setose and shallowly granular. Metapleurae gradually widening with the same angle as mesopleurae; laterals sub-obsolete and only represented by about four low nodes; the metapleural somewhat more pronounced and the supra-coxal angle just very weakly protruded. Prosternal sensory-areas weakly developed. Meso- and metasternum weakly and shallowly carinate medio-longitudinally (Fig. 31E).

Abdomen. – Median segment trapezoidal, transverse, obtuse carinate medio-longitudinally and with very small nodose pair of second paired posteriors. Entire dorsal surface of abdomen with an obtuse are comparatively distinct medio-longitudinal carina. Segment II trapezoidal; II-VII slightly sub-uniform in width and somewhat decreasing in length, all slightly transverse with VIII almost 2x wider than long. II-VI very gently narrowing and V-VII slightly decreasing in length; II sub-trapeziform, IV roughly quadrate and VI-VII slightly transverse. Terga II-VII all with a slight median narrowing. Sterna II-V with a rather broad but low and obtuse medio-longitudinal carina (Fig. 31C). Terga VIII and IX distinctly transverse with the medio-longitudinal keel posteriorly terminating in a shallow nodose swelling (Fig. 31F) and with the posterolateral angles somewhat protruded and digitiform (Fig. 31G). Anal segment longer than IX, slightly declining, keeled medio-longitudinally and somewhat narrowed posteriorly, the lateral margins angular and notably protruded at the angle; posterior margin with a wide, but distinct concave emargination and the outer angles obtusely protruded (Fig. 31G). Epiproct slightly transverse, rounded, shield-shaped and slightly projecting beyond posterolateral protrusions of anal segment (Fig. 31G). Vomer broadly triangular,

Fig. 30. *Tisamenus lachesis* (Rehn & Rehn, 1939) Live insects. **A**. Mating couple [© Gernot Kunz: https://inaturalist.ca/observations/24796645]. **B**. Captive reared ♀ from Real, Sierra Madre, Quezon Province, Luzon. **C**. Closeup of head and thorax of captive reared ♂ from Real, Sierra Madre, Quezon Province, Luzon. **D**. Captive reared ♂ from Real, Sierra Madre, Quezon Province, Luzon.

almost symmetrical with the terminal hook up-curved by almost 90°; ventral surface shallowly concave in centre (Fig. 31H). Poculum moderately bulgy, roundly cup-shaped with posterior margin narrowed, bi-lobed and with a shallow median indention (Fig. 31H).

Legs. – Long and slender for the genus with armature much reduced; the tibiae very weakly carinate and wholly unarmed. Pro- and mesofemora slightly shorter than mesothorax, metafemora reaching about halfway along abdominal segment V and metatibiae roughly reaching to tip of abdomen. Pro- and mesofemora dorsally only with two very shallow swellings in basal half and the two ventral carinae merely with two faintly indicated teeth in apical one-third. Metafemora without a ventro-basal swelling; the dorsal carinae only with four very faint swellings and the two ventral carinae with two weakly indicated and obtuse teeth in basal half and two more decided small, blunt teeth in apical half. Basitarsi very short and just slightly longer than following tarsomere.

Measurements of holotype [mm]. – Body 30.8, pronotum 2.8, mesonotum 6.3, metanotum 3.3, median segment 1.7, profemora 6.1, mesofemora 5.5, metafemora 7.2, protibiae 5.8, mesotibiae 4.9, metatibiae 6.1, antennae > 2.0.

Remarks. – Female and egg unknown.

Distribution. – East Luzon, endemic (Province Isabela, Didin [RBINS – type locality]).

***Tisamenus malawak* n. sp.**

(Fig. 32)

ZooBank: https://zoobank.org/8760796D-3665-4F76-9E36-75B6A9C1CF1B

Tisamenus sp. 9 (Camiguin), Bank *et al.,* 2021: figs 6-7.

HT, ♂: Camiguin, Philippinen, leg. Heitzmann, 2014 [ZMK, ex coll. TB].

Differentiation. – The ♂ of this small and stocky new species (the only sex known) is morphologically closest to *T. alviolanus* Lit & Eusebio, 2010 from Negros and *T. cervicornis* Bolívar, 1890 from Luzon, but can readily be separated from these two species as from all other other members of *Tisamenus* by the very broad general shape and relatively much shortened body segment with the mesothorax being notably shorter than it is wide at the posterior margin (Fig. 32A-D). Moreover, the head and body armature is less developed, the meso- and metapleural supracoxals are ca. 45° backward directed and geographically it is separated by being only known from the small island of Camiguin north off Mindanao.

Etymology. – The name of this new species (*malawak* Filipino = broad, wide) refers to the remarkably stocky shape of this small species, in whose ♂ the mesothorax is notably shorter than the width of that segment at its posterior margin, a unique morphological state within the entire genus.

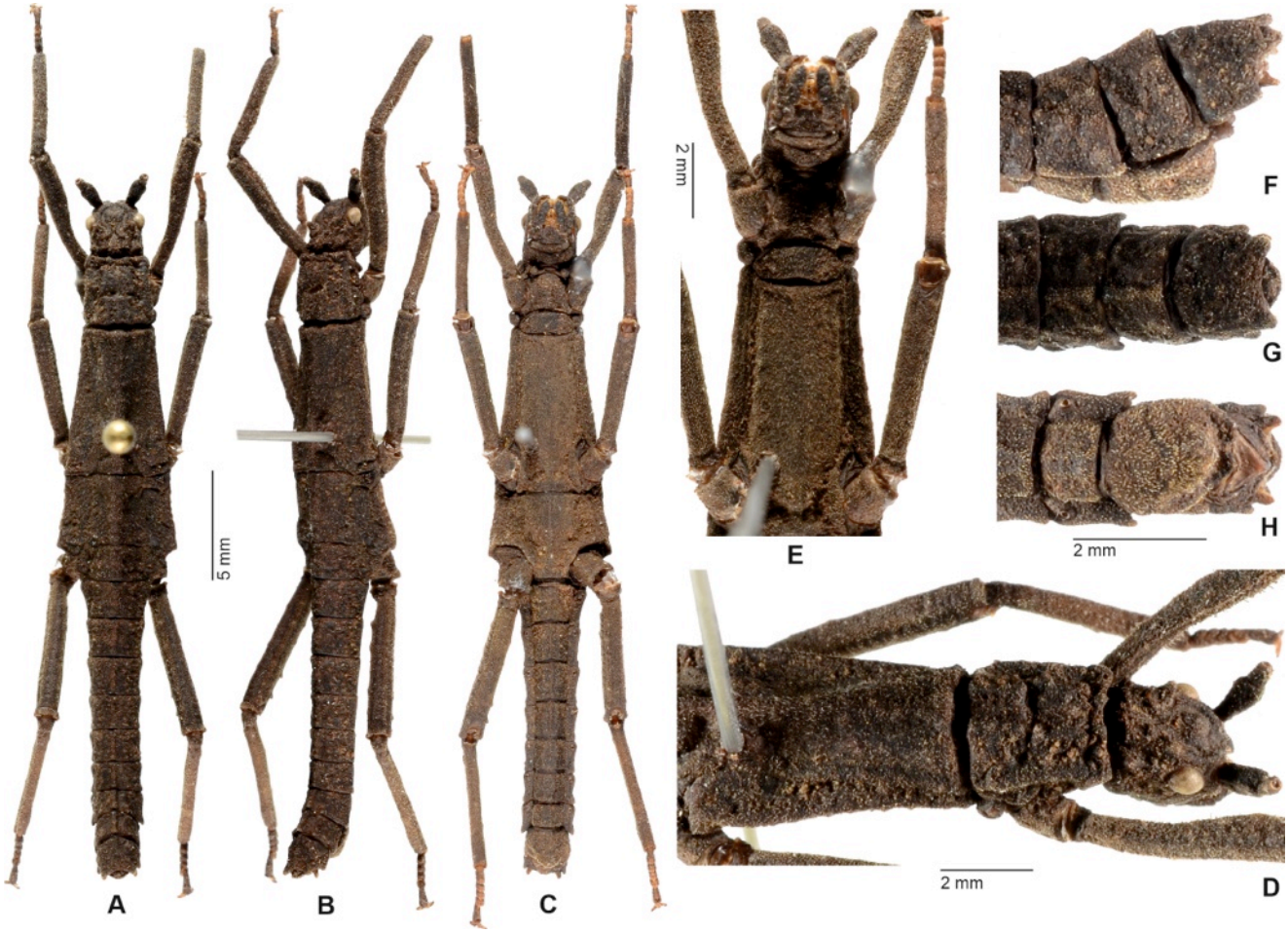

Fig. **31**. *Tisamenus makinis* **n**. **sp**. ♂ HT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Ventral view. **D**. Closeup of head, pro- and mesonotum. **E**. Closeup of head, pro- and mesosternum. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view.

Description

♂ (Fig. 32)

Form and colouration. – Size small for the genus (body length 29.0 mm); general form very heavy and broad, legs short and strong with the meso- and metafemora distinctly incrassate; elements of armature rather moderately developed. Meso- and metathorax strongly gradually widening towards posterior and together forming a trapeziform unit; body surface unevenly granular. General colour reddish fuscous dorsally, the ventral body surface rather buff to walnut brown; medio-longitudinal dorsal keel of thorax and all larger elements of thoracic armature russet, the teeth and spines of abdomen and limbs as well as the medio-longitudinal carina of mesosternum ochre. Ten terminal antennomeres glossy, the basal joints drab.

Head. – Sub-quadrate, a little wider than long with the genae weakly convergent. Entire armature rather weakly developed; the three supra-orbitals moderately conical, tuberculate with the median one largest; occipitals and coronals rather low, tuberculate (Fig. 32H). Three gulars small and nodose. Vertex with coronal line slightly indented. Eyes of average size, moderately globose and their diameter corresponding to scarcely less than half the length of gena. Antennae strong with the basal half perlamorph and consisting of 24 joints; scapus roundly triangular in dorsal aspect, pedicellus about half as long and cylindrical; III slightly longer than pedicellus, IV very short, transverse and only one-third the length of III; III-X sub-globose and somewhat increasing in length, XI-XXIII very slightly decreasing with the terminal antennomere notably elongated and almost as long as two preceding joints taken together.

Thorax. – Pronotum sub-trapeziform, notably wider than long; triangular area fairly distinct with margins unevenly tubercular and the anterolateral angles with a strong and obtuse bifid tubercle; disc otherwise shallowly nodose and the posteriors somewhat enlarged and weakly tubercular. Mesothorax strongly widening towards posterior, distinctly trapezoidal in outline with width at posterior margin notably greater than length; almost 2x longer than prothorax and with posterior portion 1.5x wider than anterior margin. Mesonotum elongate, posterior half narrowed and lateral margins distinctly constricted post-medially; about 1.6x longer than width at anterior margin. Mesonotal triangular area small, scarcely more than one-third as long as notum and a little shorter than width across anterolateral angles, disk weakly indented with some nodes along the median line, the converging outer margins unevenly granular and anteriorly protruded into a n obtusely conical swelling; the anterior margin with a pair of low anterior mesonotals (Fig. 32H). Posterior portion of mesonotum with a distinct medio-longitudinal keel that is covered by two rows of low, shiny granules. Mesopleurae strongly expanding towards the posterior and triangular in dorsal aspect, the lateral margins densely granular and the four laterals merely represented by low rounded nodes (antero-lateral slightly tubercular); an irregular medio-dorsal longitudinal row of nodes present; mesopleural a rather strong somewhat posterior directed and simple, conical tubercle. Metanotum roundly trapezoidal in outline and with the same medio-longitudinal keel seen on mesonotum, bearing two rows of shiny granules. Metapleurae strongly expanded with laterals sub-obsolete, the metapleural somewhat more pronounced and the migrated supra-coxal angle with a strong but short bifid and somewhat posterior directed supra-coxal tubercle. Probasisternum with a widely spaced pair of low but distinct nodes (Fig. 32I). Mesosternum distinctly tri-carinate with the lateral carinae somewhat arched and irregular; between mesocoxae with a prominent, gibbose and minutely granular swelling. Metasternum only with a faintly indicated medio-longitudinal carina (Fig. 32I).

Abdomen. – Median segment almost semi-circular in outline, carinate medio-longitudinally and with a small node-like pair of first and second paired posteriors (the medio-longitudinal keel like on meso- and metanotum). Segments II-VII slightly decreasing in length and width, all transverse with VII shortest and 2.2x wider than long; II trapeziform. Terga II-IV with a strong pair of second pared posteriors, that is spinose on II and III, tubercular on IV and merely represented by small tubercles on V. The medio-longitudinal carina bi-lineate and granular but rather weak on V-VII. Sterna II-VII with a fine medio-longitudinal carina, II-IV with a low pair of medial nodes. Tergum VIII wider than VII and almost 3.3x wider than long, IX narrower; both with the medio-longitudinal keel posteriorly protruded into an obtusely dentiform

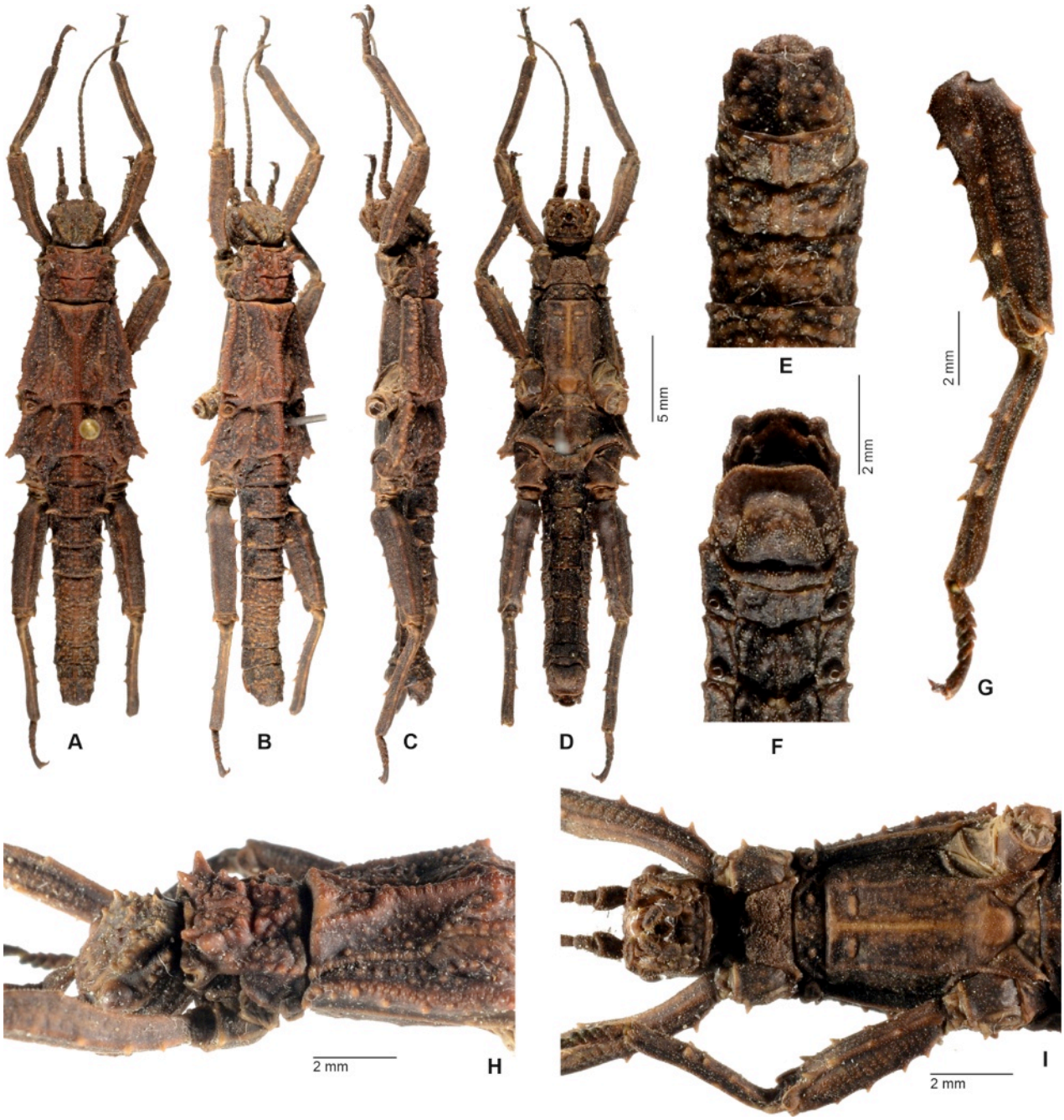

Fig. 32. *Tisamenus malawak* **n. sp.** ♂ HT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Terminalia in dorsal view. **F**. Terminalia in ventral view. **G:** Anteroventral view of left hind leg. **H**. Closeup of head, pro- and mesonotum.. **I**. Closeup of head, pro- and mesosternum.

swelling. Anal segment declining and cucullate in lateral aspect, somewhat narrowing towards the posterior with a pair of latero-anterior nodes; lateral margins angular and concave in posterior half; posterior margin with a wide, shallow, bi-concave median emargination and the outer angles obtusely protruded (Fig. 32E). Epiproct fairly large, transverse, rounded and slightly projecting beyond posterolateral protrusions of anal segment (Fig. 32E). Vomer very braid, transverse and with a short terminal hook, that is slightly migrated dextrally. Poculum roundly cup-shaped, somewhat narrowing towards the posterior with a broad and labiate posterior flange of the free upper margin, that is very shallowly concave posteriorly and reaches two-thirds the way along anal segment (Fig. 32F).

Legs. – Short and strong with all the dentations well developed; the femora but metafemora in particular distinctly incrassate. Profemora as long as, mesofemora slightly shorter than mesothorax, metafemora reaching about halfway along abdominal segment VI and metatibiae surpassing tip of abdomen by about the length of anal segment. Profemora with three teeth on posterodorsal carina; meso- and metafemora essentially with four teeth on each of the four carinae, the ventral ones of which are somewhat large and more spinose. Dorsal teeth of metafemora decreasing in size towards apex of femur, the two apical ventral ones spinose; ventro-basal swelling of metafemora distinct, sub-globose and smooth (Fig. 32G). All tibiae smooth dorsally; pro- and mesotibiae with single dentiform ventral swellings, metatibiae with three rather distinct triangular teeth on ventral carinae (Fig. 32G). Basitarsi short and just slightly longer than following two tarsomeres taken together.

Measurements of holotype [mm]. – Body 29.0, pronotum 3.2, mesonotum 5.7, metanotum 3.2, median segment 1.7, profemora 6.0, mesofemora 5.0, metafemora 6.4, protibiae 5.9, mesotibiae 4.9, metatibiae 6.6, antennae 10.5.

Remarks. – The holotype is the voucher specimen of the sample sequenced for the molecular study by Bank *et al.* (2021) and referred to as "*Tisamenus* sp. 9 (Camiguin)". Thus, the specimen lacks the left mid leg (Fig. 32AVD). Female and egg unknown.

Distribution. – Camiguin, endemic [RBINS – type locality].

***Tisamenus napalaki* n. sp.**

(Fig. 33-35, 46Q-R)

ZooBank: https://zoobank.org/D2C6C9D6-F283-4AB1-AAC8-B07F0479670C

Hoploclonia draconinus, Matsumura & Hirayama, 1932: fig. (Misidentification)

- Shiraki, 1935: 24. (Misidentification)

- Chen & He, 2008: 360, pl. 4: 4. (Misidentification)

Hoploclonia draconia, Huang, 2002: 84, figs. (Misspelling of *draconinus* and misidentification)

- Xu, 2005: 335. (Misspelling of *draconinus* and misidentification)

HT, ♂: Coll. R.I.Sc.N.B., Philippines, N Luzon, Cagayan, Sta Ana, vi.2014, 18°28'N 122°09'E, Leg. I. Lumawig, gift from B. Kneubühler, I.G.: 32.613 [RBINS].

PT, **2** ♀, **1** ♂: Coll. R.I.Sc.N.B., Philippines, N Luzon, Kalinga, vi.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS].

PT, **2** ♂: Coll. R.I.Sc.N.B., Palaui Island, ex. breeding, N. Wuyts [RBINS].

PT, **5** ♀, **6** ♂, **1** egg: Philippinen, N Luzon Id., Prov. Cagayan, Pampanga, Santa Ana, sealevel, local collector VIII.2012 [FH, No's 1519-1 to 9, E1].

PT, **4** ♀: ex Zucht: Tim Bollens 2019, Herkunft: Philippinen, N-Luzon, Palaui Isl., Prov. Cagayan, Barangay, San Vicente [FH, No's 1519-10 to 13].

PT, **1** ♀, **7** ♂, **4** ♀ (immature), **22** eggs: ex Zucht: F. Hennemann 2020, Herkunft: Philippinen, N-Luzon, Palaui Isl., Prov. Cagayan, Barangay, San Vicente [FH, No's 1519-14 to 25, E2].

PT, **1** ♀: San Pablo, Isabela, E-Luzon, leg. I. Lumawig VII.2015, leg. Lumawig 2015 [TB].

Differentiation. – This large and characteristic species shows the closest affinity to the other species with four mesopleural spines *T. draconinus* (Westwood, 1859) from Luzon. From *draconinus* both sexes of this species are distinguishable by the notably larger dimensions, slightly slenderer shape and generally more pronounced armature of the body with all the major spines comparatively longer and slenderer. Moreover, both sexes clearly have two metapleural laterals (Fig. 33A) instead of only one as in *draconinus* (Fig. 17A), which perhaps is the most obvious differential character. Males may also be distinguished by the less evident mesothoracic constriction at the 3rd mesopleural lateral, characteristic gibbous dorsal swelling of abdominal terga II-V (Fig. 35I) and much larger pair of posteriors on terga II-III as well as the less distinct ventro-basal swelling of the meso- and metafemora (Fig. 35L-M). The eggs (Fig. 46Q-R) are larger and somewhat more elongate than those of *draconinus*, and readily separated by the much more developed sculpturing of the capsule surface and smaller, broader micropylar plate, which is only about three-quarters the length of the capsule (as much as seven-eighths the length of capsule in *draconinus*) and has all three extensions notably shorter and wider.

Etymology. – The name of this new species (*napalaki* Filipino = inflated) refers to the characteristically inflated abdominal terga II-V in ♂ of this remarkable new species (Fig. 35I), which is the most colourful in the entire genus, with ♀ showing pretty colour patterns including tones of white, cream, yellow and black and ♂ often with pretty orange to reddish colours.

Description

♀ (Fig. 33)

Form and colouration. – Size large (body length 64.0-69.0 mm); general form moderately slender and elongate; the elements of armature strongly developed and mostly spinose, the anterolateral spines of the triangular mesonotal area compound (Fig. 35A); legs elongate and slender with rather weakly developed but spinose rather than dentate armature. Body surface unevenly granular. Colouration very variable and complex for the genus, often with unusual ochre, orange and red tones and patterns. General colour mostly ranging from fairly plain drab or ochre over various tones of brown and fuscous to almost black; median portion of abdominal terga II-VII often cream, ochre to clay coloured with the lateral surfaces dark brown to blackish. Meso- and metasternum lighter in colour than dorsal body surface and buff to almost clay coloured with the three small mesosternals each marked by a blackish spot (Fig. 33G, 34B). Pro-, meso- and metanotum as well as abdominal terga I-II with an ochre, orange or reddish medio-longitudinal streak that is laterally bordered by a narrow blackish line; this broad on pronotum; narrow but covering most of disc of triangular area on mesonotum, narrow on metanotum and median segment and widened into an almost circular marking on abdominal tergum II. Femora mid to dark brown or almost black and flecked with ochraceous tones ventrally. Largest spines of head and body with apical half dark brown and tipped with orange. Antennae uniformly black but becoming rather greyish towards the base.

Head. – Rectangular, longer than wide with the genae weakly widening towards the posterior. The supra-orbital large and spinose with a few small tubercles around base; occipitals and median coronals small and tubercular; the lateral coronals sub-spinose, conical and notably larger than median coronals, the latter slightly larger than occipitals (Fig. 35A). Eyes small, hemispherical and their diameter corresponding to about 0.4x length of gena. Genae supplied with 2-3 low, nodose to tuberculate gulars. Antennae slender with all joints except IV longer than wide and consisting of 26 joints; scapus weakly triangular in dorsal aspect, pedicellus about half the length of scapus and almost cylindrical; III slightly longer than pedicellus, IV much shorter, following increasing in length up to XV, then slightly decreasing in length with the terminal antennomere much elongated and slightly longer than preceding two joints combined.

Thorax. – Pronotum sub-quadrate; triangular area moderately indicated with margins behind the transverse median sulcus bounded by small tubercles; anterolaterally with a strong bifid spine, whose second spike usually is somewhat longer than the anterior one; behind the bifid anterior spine with one or two spiniform tubercles (Fig. 35A). Mesothorax fairly slender, slightly widening towards the posterior, about 2.1x longer than prothorax and with posterior portion 1.3x wider than anterior margin. Mesonotum weakly sub-trapeziform with lateral margins obliquely convergent towards the posterior and with a very shallow median narrowing, about 2.1x longer than width at anterior margin; the triangular area roughly attaining middle of notum, longer than wide, disk shallowly concave and the almost straight margins tubercular with the anterolateral angles protruded into a composite, 3-4 spinose crest that has the median spike notably longer than the others, all acutely spinose; the anterior margin of triangular area with a dentiform median protrusion (Fig. 35A). Posterior portion of mesonotum with a broad and shallowly granulate medio-longitudinal bulge, that is faintly indicated in the triangular area; pre-posteriorly with a distinct, bi-spinose swelling. Mesopleurae somewhat expanding towards the posterior and narrowed at anterior margin with four large and spinose laterals; the antero-lateral small than the following, the second and third represented by long and acutely pointed spines and the slightly smaller mesopleural with a variable number of small tubercles around the base. Metanotum sub-rectangular and a little longer than wide with a slight median narrowing, surface with the same granulose medio-longitudinal bulge and pre-posterior bi-spinose swelling seen on mesonotum. Metapleurae with two prominent and spinose laterals, the anterior one of which is smaller; metapleural small, tubercular and the supra-coxal angle with a strong more or less compound supra-coxal spine that is accompanied by a variable number of spiniform tubercles around its base. Mesosternum tri-carinate, the lateral carinae somewhat irregular, converging towards the posterior and supplied with three shallow node-like mesosternals (Fig. 35B); metasternum with a n obtuse medio-longitudinal carina and a few faint indications of metasternals laterally (Fig. 34G).

Abdomen. – Median segment distinctly trapezoidal with anterior margin weakly rounded; the medio-longitudinal carina shallow and with two small nodes pre-posteriorly. Segments II-III roughly equal in length and width and rectangular, IV-VII slightly decreasing in length and V-VII notably narrowing; II and III about 2x wider than long, VII only 1.6x wider than long and narrowest of all segments. All terga with two weakly indicated and closely spaced, parallel medio-longitudinal carinae; II-IV with prominent second-paired posterior spines (Fig. 34D-E) and a variably but small and conical posterior mesal; the second paired posteriors only represented by small spinose tubercles on V. Sterna II-VII only with weakly indicated posterior medials, otherwise simple and minutely granular (Fig. 34G); praeopercular organ formed by a two shallow, converging bulges that posteriorly terminate in a small swelling (Fig. 35F). Tergum VIII

Fig. **33**. *Tisamenus napalaki* **n**. **sp**. ♀.

A. PT, dorsal view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon – arrows pointing to the two metapleurals that readily distinguish this species from *T. draconinus*) [FH 1519-5]. **B**. PT, dorsal view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-14]. **C**. PT, dorsal view (from Santa Ana, Cagayan Province, N-Luzon) [FH 1519-13]. **D**. PT, dorsolateral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-14]. **E**. PT, dorsolateral view (from Santa Ana, Cagayan Province, N-Luzon) [FH 1519-5]. **F**. PT, lateral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-13]. **G**. PT, ventral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-13]. **H**. PT, live captive reared specimen (PT) from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon. **I**. PT, live captive reared specimen (PT) from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon.

trapezoidal in dorsal view, IX obtusely tectate with an obtuse, triangular posteromedian protrusion that is formed by the two medio-longitudinal carinae (Fig. 35C). Anal segment strongly declining with the lateral margins obliquely convergent in posterior half and with a fairly well developed medio-longitudinal carina; the posterior margin broadly bi-lobed with a shallow median indention (Fig. 35D-E). Epiproct weakly tectate longitudinally with an indication of a medio-longitudinal carina and slightly cucullate (Fig. 35C), the lateral margins almost parallel-sided and the posterior margin roundly angular (Fig. 35D-E). Subgenital plate fairly elongate, notably projecting beyond epiproct, navicular, distinctly carinate in posterior half with the apex narrowed and pointed (Fig. 35F).

Legs. – All slender and elongate with the teeth rather moderately developed and fairly spinose; the two apical ventral teeth of meso- and metafemora rather small and those on the dorsal carinae of the meso- and metafemora distinctly spinose and the largest elements of leg armature. Profemora almost as long as mesothorax, mesofemora notably shorter; metafemora somewhat projecting over posterior margin of abdominal segment IV and metatibiae reaching to posterior margin of tergum VIII. The one or two basal spines on the two dorsal carinae of meso- and metafemora notably arched towards base of femur. All tibiae unarmed dorsally, mesotibiae only with a few weakly indicated denticles ventrally and metatibiae with about eight acute teeth on two ventral carinae. Basitarsi rather elongate, almost as long as following three tarsomeres taken together.

Measurements of paratypes [mm]. – Body 64.0-69.0, pronotum 5.0-5.3, mesonotum 11.0-11.5, metanotum 6.0-6.2, median segment 2.7-2.8, profemora 11.1-12.0, mesofemora 10.3-10.6, metafemora 13.8-14.6, protibiae 11.7-12.7, mesotibiae 10.8-11.2, metatibiae 14.9-16.0, antennae 25.0-27.0.

♂ (Fig. 35)

Form and colouration. – Size rather large (body length 44.0-50.0 mm), general form fairly slender and elongate, the elements of armature prominent and essentially like in ♀ but comparatively more developed; abdominal terga II-V with a gibbous swelling (Fig. 35I) and the legs broader and stouter than in ♀ with the metafemora moderately incrassate and more heavily armed tan in ♀ (Fig. 35L). Colour essentially like in ♀ but the medio-longitudinal streak along dorsal body surface often continued up to abdominal tergum VIII and more commonly orange to red than in ♀. Terminal antennomere buff.

Head. – Like in ♀ but the anterior supra-orbital notably longer (Fig. 35N) and the eyes proportionately larger with their diameter corresponding to about 0.5x the length of gena. Antennae proportionally longer and almost reaching to posterior margin of metanotum.

Thorax. – Pronotum essentially as in ♀ but less trapeziform in outline and the bi- or trifid anterior much longer; like in ♀ the median spike usually the longest. Mesothorax 2.2x longer than prothorax and slightly narrowed anteriorly and medially. Mesonotum sub-trapezoidal with the lateral margins slightly converging towards the middle and then with a slight pre-posterior widening, about 2.2x longer than width at anterior margin; the triangular area relatively more elongate than in ♀ being about 1.6x longer than width across anterolateral angles and roughly reaching to middle of notum; the lateral margins strongly raised, obtusely granular and the anterolateral angles protruded into a large bifid spine whose first spike is small and sub-spiniform and the second a large and upright spine (Fig. 35N). Posterior portion of mesonotum with a distinct medio-longitudinal bulge that is weakly indicated in the concave interior region of the triangular area; pre-posteriorly with a prominent conical swelling that bears two lateral directed spines. Mesopleurae weakly narrowed medially with elements of armature like in ♀ but more spinose, much longer and the mesopleural with less small tubercles arounds its base; the second and third mesopleural laterals laterally projecting by at least half the width of mesothorax. Metanotum longer than wide, narrowed anteriorly and with the lateral margins convex in posterior half; surface with the same medio-longitudinal bulge and bis-spinose pre-posterior median swelling seen on mesonotum. Metapleurae with armature like in ♀ but the spines all much longer and slenderer. Mesosternum tri-carinate, the median carina prominent and the lateral carinae very close to lateral margins of sternum (Fig. 35M). Metasternum with a medio-longitudinal keel and metasternals indicated by a few small and uneven granules (Fig. 35G).

Abdomen. – Median segment distinctly trapezoidal in outline with the anterior margin angular and the anterolateral areas somewhat impressed. Segments II-VII distinctly decreasing in length a very slightly narrowing, II-IV sub-quadrate and scarcely longer than wide, V-VII wider than long and VII narrowest of all segments; terga II-V with the posterior half strongly swollen gibbous; the second paired posteriors merely present on terga II and III and represented by strong spines, on IV merely indicated as small tubercles (Fig. 35H-I). A medio-longitudinal carina only seen in anterior portion of II-V and more definite over entire length of VI-IX. Sterna II-III with a distinct medio-longitudinal keel that is less obvious on IV, just weakly indicated on V and missing on VI-VII. Terga VIII and IX transverse and trapezoidal in outline with an obtuse dentiform posteromedian protrusion; the posterolateral angles of VIII and IX somewhat digitiform. Anal segment distinctly trapezoidal, somewhat declining towards the posterior, the lateral margins angular with an obtuse tooth at the angle and the posterior margin shallowly concave with the outer angles obtusely protruded (Fig. 35J). Epiproct broadly transverse, shield-shaped and rounded (Fig. 35J). Vomer shorter than width at base, the ventral surface with some irregular transverse ridges, the outer margin somewhat convex and the terminal hook prominent, triangular and somewhat sinistral directed. Poculum rather shallowly cup-shaped with the posterior flange very broad, weakly bi-labiate and emarginate medially (Fig. 35K).

Legs. – All stockier with all teeth comparatively more developed than in ♀. Pro- and mesofemora shorter than mesothorax, metafemora reaching about half the way along abdominal segment V and metatibiae at best slightly projecting beyond tip of abdomen. Ventral teeth more spiniform than those on dorsal carinae; the two basal spines on the dorsal carinae of the meso- and metafemora somewhat arched towards the base of femur. Ventro-basal portion of metafemora weakly gibbose and the two outer ventral carinae armed with a variable number of variably sized but distinct spiniform teeth; the ventral carinae of metatibiae armed with about 12-18 unevenly sized, acute teeth (Fig. 35L). Tarsi like in ♀.

Measurements of holotype [mm]. – Body 45.8, pronotum 4.1, mesonotum 8.8, metanotum 5.0, median segment 2.6, profemora 9.7, mesofemora 8.3, metafemora 10.4, protibiae 9.8, mesotibiae 8.6, metatibiae 11.0, antennae 20.0.

Measurements of **paratypes** [mm]. – Body 44.0-50.0, pronotum 3.8-4.6, mesonotum 8.7-9.3, metanotum 4.1-5.1, median segment 2.5-2.8, profemora 8.6-9.0, mesofemora 7.0-8.0, metafemora 9.3-10.5, protibiae 8.7-9.0, mesotibiae 6.8-8.7, metatibiae 9.7-11.0, antennae 18.0-21.0.

Variability. – This remarkable species shows slight variability in the armature of the head, body and limbs in both sexes, where the most decisive variability is seen in the size and shape of the pronotal and mesonotal anteriors. The most striking variability is seen in the colouration of both sexes, which is illustrated in Fig. 33-35. Both sexes range in general colour from drab or ochre over various tones of brown and fuscous to almost black and the dark yellow, orange to almost red distinctive medio-longitudinal streak of the meso- and metanotum is variable in its intensity. Males may also occur in almost wholly orange to red morphs (e. g. Fig. 34H-I).

Egg (Fig. 46Q-R)

Large for the genus; capsule ovoid, slightly and somewhat narrowed posteriorly, oval in cross-section with the lateral surfaces almost parallel-sided in median portion and with a fairly distinct posterior indention of polar-area; higher than wide with dorsal surface bulgier than ventral surface; capsule about 1.5x longer than wide. A slight constriction just below the somewhat inflated and minutely tubercular anterior margin. Surface all over covered with an irregular meshwork of ridges that are densely supplied with fringy to setose excrescences; the fringy carinae only wanting in the very antero-dorsal and lateral portion of capsule. The capsule otherwise densely and minutely granular. Micropylar plate rather small and just scarcely more than 0.7x the length of capsule; Y-shaped with the median portion broad, gently tapering and clearly not attaining anterior of capsule; the two posterolateral extensions somewhat slenderer, rather short and on lateral surfaces roughly reaching axis of egg capsule. Posterior portion 70° V-shaped and with a small but distinct bowl-shaped micropylar cup in centre. Outer margin of plate marked by a rim of fringy excrescences, the inner portion somewhat inflated, bordered by short fringy protuberances along the outer margin and only with a few scattered protuberances interiorly; the fairly narrow space between outer margin of capsule and the raised interior portion forming an un-sculptured indented rim. Median liner distinct and formed by a fringy bulge that reaches as far as to the polar-area. Operculum inserted into capsule at an angle of about -5° and very slightly oval in

Fig. **34**. *Tisamenus napalaki* **n**. **sp**. ♀ details and live insects.

A. PT, closeup of head, pro- and mesonotum (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-13]. **B**. PT, closeup of head, pro- and mesosternum (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-13]. **C**. Terminalia in lateral view. **D**. Terminalia in dorsal view. **E**. Terminalia in dorsal view [FH 1519-5]. **F**. Terminalia in ventral view. [FH 1519-5]. **G**. Live captive reared couple (PT) from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon (dark brown ♂ with orange medio-longitudinal dorsal streak). **H**. Live captive reared almost wholly orange ♂ (PT) from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon. **I**. Live captive reared almost wholly orange ♂ (PT) from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon.

Fig. **35**. *Tisamenus napalaki* **n**. **sp**. ♂.

A. Dark brown PT with contrastive orange medio-longitudinal dorsal streak, dorsal view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon – arrows pointing to the two metapleurals that readily distinguish this species from *T. draconinus*) [FH 1519-21]. **B**. Buff to ochre PT with weakly indicated yellow medio-longitudional dorsal streak, dorsal view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-18]. **C**. Dark russet PT with a very narrow red medio-longitudinal dorsal stripe, dorsal view (from Santa Ana, Cagayan Province, N-Luzon) [FH 1519-9]. **D**. PT, dorsolateral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-21]. **E**. PT, dorsolateral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-18]. **F**. PT, lateral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-21]. **G**. PT, ventral view (captive reared from San Vicente, Barangay, Palaui Island, Cagayan Province, N-Luzon) [FH 1519-21]. **H**. PT, dorsal view of abdomen [FH 1519-19]. **I**. PT, dorsal view of abdomen, showing the typical inflated, gibbous posterior portion of the basal terga [FH 1519-19]. **J**. PT, terminalia in dorsal view. **K**. PT, terminalia in ventral view [FH 1519-9]. **L**. PT, anteroventral view of left hind leg. **M**. PT, closeup of head, pro- and mesosternum. **N**. PT, closeup of head, pro- and mesonotum.

outline. The outer margin with a narrow collar of fringy protuberances and in the middle portion with a distinct circular rim of fairly long fringes; the centre indented. Colour dark blackish brown to almost with all the fringy protuberances of the capsule, micropylar plate and operculum ochraceous to dark olive. Measurements [mm]: Length incl. operculum 4.4, length 4.2, width 2.8, height 3.0, length of micropylar plate 3.1.

Remarks. – A specimen recorded from the island of Kotosho southeast of Taiwan and misidentified as "*Hoploclonia draconinus*" and illustrated by Matsumura & Hirayama (1932) actually is an immature ♀ of this new species, which is distributed in the very northeast of Luzon. Although there are no records of *T. napalaki* **n**. **sp**. from the small islands situated in the Luzon Strait, namely the Babuyan and Batanes Islands, a natural occurrence on Kotosho Island is very unlikely and can most certainly be associated to a meteorological event like a typhoon (see remarks on *T. draconinus* for more information).
In June 2016 Albert Kang (Singapore) collected specimens on the island of Palaui and passed these on to Thierry Heitzmann (Philippines), who was able to breed the stock in captivity and sent eggs laid by the F1-generation to Europe. These have given rise to a culture that is since maintained and popular among European breeders because of the remarkably pretty colouration. The species has been distributed as *Tisamenus* sp. 'Palaui' but has not yet been given a Phasmid Study Group culture number.

Distribution. – N-Luzon: Province Cagayan (Santa Ana [RBINS – type locality; photographic record by Albert Kang: https://inaturalist.ca/observations/130746863]; Papanga, Santa Ana [FH]; San Vicente, Palaui Island [FH]); Province Kalinga, Balbalan [RBINS]).

Tisamenus polillo (Rehn & Rehn, 1939)
(Fig. 36-37, 46S-T)

Hoploclonia polillo Rehn & Rehn, 1939: 483, pl. 31: 6.

HT, ♂: Polillo Is., P.I. (Taylor); *Hoploclonia polillo* Rehn & Rehn, Type #. 1254; Data Base Serial No. Assigned as Type No. September 2008. Type #9127 [ANSP].

- Otte, 1978: 79. (Type data)

Tisamenus polillo, Zompro, 2004: 207.

- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Type #.1346; Data Base Serial No. Assigned as Type No. September 2008. Type #9128

Material examined

1 ♂: Philippines, C.S. Banks, 1908-228; Acc. No. 8541, Lot Bu. of Sci., P.I.; *Obrimus* sp. juv.; *Hoploclonia* cf. *lachesis* Rehn & Rehn, 19039 ♂, det. O. Zompro X.2000; NHMUK 012497255 [NHMUK];

1 ♀: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, ii.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS];

2 ♂: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, ii.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS];

1 ♀: Coll. R.I.Sc.N.B., Philippines, N Luzon, Calinga, Pinukpok, IX.2014, local collector, I. Lumawig [RBINS];

1 ♀, **1** egg (ex ovipositor): Philippinen, Ost Luzon Island, Provinz Aurora, Sierra Madre, Dingalan, 230 m, local collector X.2012 [FH, No. 1182-1 & E];

1 ♂: Philippinen, Zentral Luzon, Provinz Laguna, Santa Rosa, local collector, VII.2004 [FH, No. 1182-2].

Differentiation. – The ♀ of this fairly distinctive species are morphologically closest to those species with four mesopleural spines, namely *T. napalaki* **n**. **sp**. and *T. draconinus* (Westwood, 1848), but also to *T. lachesis* (Rehn & Rehn, 1939), all of which are also distributed on the island of Luzon. These ♀ however differ from the two former species by the slenderer overall shape and slenderer, proportionally longer limbs as well as having only three prominent mesopleural spines, with the anterolateral just moderately spiniform and the metapleurae unarmed except for a single but fairly distinct metapleural spine that bears a much smaller tubercle or spine above. Moreover, the meso- and metanotum lack intero-posteriors (Fig. 36D, G), the converging carinae of the mesonotal triangular area are only triangularly produced anteriorly and lack any notably enlarged spines (Fig. 36L)M), the medio-longitudinal carina of the meso- and metasternum is much less pronounced (Fig. 36C) and the metatibiae are merely supplied with some obtuse nodes and lack distinct spines on the ventral carinae. From *lachesis* they may be separated by the somewhat smaller size, having only three mesopleural spines, of which only the mesopleural is frequently spinose (always five distinct mesopleural spines in *lachesis*), entire lack of metapleural laterals, lack of paired inter-posterior meso- and metanotals, weakly protruded anterior angle of the carinae of the triangular mesonotal area (strongly raised and more or less spinose in *lachesis*) and lack of second paired posterior spines on abdominal tergum V (Fig. 36B, F). Males of *polillo* are morphologically most similar to *T. kalahani* Lit & Eusebio, 2005 from Luzon and *T. lachesis* (Rehn & Rehn, 1939). With the first species they share the unusually slender overall shape and often reduced lateral armature of the meso- and metapleuare. These ♂ are however readily separable by the more pronounced head and body armature including large and spinose supra-orbital spines, prominent bi- or tri-spinose anterior pronotals (Fig. 37L-M), distinct spinose meso- and metapleurals, a spinose anterior angle of the carinae of the triangular mesonotal area and presence of small second paired posterior spines on abdominal terga II and III. Moreover, the limbs are comparatively more robust in this species and have all the teeth more pronounced than in *kalahani*. From *lachesis*, the ♂ of *polillo* can be distinguished by the slenderer overall shape and more delicate limbs, having at best four mesopleural spines (always five distinct spines in *lachesis*), lack of a metapleural lateral, lack of paired inter-posterior meso- and metanotals (Fig. 37E), weakly protruded anterior angle of the carinae of the triangular mesonotal area (Fig. 37L-M; strongly raised and more or less spinose in *lachesis*) and less acute medio-longitudinal carina of the mesosternum (Fig. 37F). The eggs (Fig. 46S-T) rather resemble those of *draconinus* but are less wide and also differ by the much shorter micropylar plate, that covers only about three-quarters of the capsule length and has the three extensions notably broader. In aspect of the sculpturing of the capsule they represent an intermediate between the almost smooth capsule seen in *draconinus* and the capsule of *napalaki*, that is all over covered with a dense network of fringy ridges.

Description

♀ (Fig. 36)

Form and colouration. – Medium-sized (body length 54.5-58.0mm); general form rather elongate with the elements of armature moderately developed and with only three mesopleural spines; limbs comparatively very slender and elongate. Colour ranging from chestnut brown to reddish dark brown with darker and lighter areas, the carinae of the triangular mesonotal area and the medio-longitudinal keel of the meso- and metanotum contrastive to base colour of body. Limbs but meso- and metatibiae to a variable degree flecked with ochraceous tones. Meso- and metasternum buff; all the larger spines of thorax and abdominal terga dark brown with orange tips. Antennae with the terminal four joints lighter in colour than all preceding and rather ochraceous.

Head. – Essentially like in ♂, the genae very slightly widening towards posterior; supra-orbitals fairly prominent, conical and accompanied by small tubercles around base; occipitals small, tubercular; coronals somewhat more pronounced, tubercular; surface of vertex generally unevenly granular to sub-tubercular (Fig. 36L-M). Genae only with 2-3 very low, granular gulars. Eyes comparatively smaller than in ♂, sub-globose and their diameter corresponding to somewhat more than 0.4x the length of gena. Antennae slightly surpassing apex of protibiae and with 26 segments; scapus sub-

Fig. **36**. *Tisamenus polillo* (Rehn & Rehn, 1939) ♀.

A. Dorsal view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **B**. Dorsolateral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **C**. Ventral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **D**. Lateral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **E**. Dorsal view (from Dingalan, Aurora Province, Sierra Madre, E-Luzon) [FH 1182-1]. **F**. Dorsolateral view (from Dingalan, Aurora Province, Sierra Madre, E-Luzon) [FH 1182-1]. **G**. Lateral view (from Dingalan, Aurora Province, Sierra Madre, E-Luzon) [FH 1182-1]. **H**. Terminalia in lateral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **I**. Terminalia in dorsal view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS].**J:** Terminalia in ventral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **K**. Closeup of head, pro- and mesosternum (from Dingalan, Aurora Province, Sierra Madre, E-Luzon) [FH 1182-1]. **L**. Closeup of head, pro- and mesosternum (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **M**. Closeup of head, pro- and mesonotum (from Dingalan, Aurora Province, Sierra Madre, E-Luzon) [FH 1182-1].

trapezoidal in dorsal aspect and almost 2x longer than wide; pedicellus about half as long as scapus, round in cross-section and a little constricted towards apex; III slightly longer than pedicellus, IV much shorter and the following up to XIV somewhat increasing, the following decreasing in length; terminal antennomere elongated and about as long as two preceding joints combined (Fig. 36M).

Thorax. – Pronotum sub-trapeziform, the triangular area more pronounced in the post-sulcal area and marked by low tubercles; anteriors prominent, covering entire length of pre-sulcal area, crest-like and 3 to 5-tuberculate, with the anterior element largest and projecting over anterior margin of notum (Fig. 36L-M). Mesothorax rather elongate and slightly but progressively widening towards posterior, about 2.4x longer than prothorax. Mesonotum almost rectangular with a slight constriction about one-third before posterior margin; 2.1x longer than width at anterior margin; triangular mesonotal area very slightly surpassing middle of notum, notably longer than width over anterolateral angles, the convergent lateral margins arched anteriorly and distinctly tuberculate with the anterolateral angles protruded into a somewhat enlarged sub-spiniform tubercle; interior surface shallowly concave (Fig. 36L-M); posterior portion of notum with a distinct, granular medio-longitudinal carina that is weakly indicated in the posterior portion of the triangular area. Mesopleurae moderately expanding towards posterior with outer margin minutely tuberculate and armed only with two spines in posterior two-thirds, that range tubercular to long and acutely spinose and bear two minute tubercles at their base; antero-lateral ranging from sub-obsolete to conical and tubercular; mesopleural strong, spinose but more stout than laterals and compound, bearing 1-3 small tubercles at base. Metanotum trapeziform, about 0.4x length of mesonotum and with the medio-longitudinal keel like in mesonotum. Metapleurae with laterals merely represented by sub-tuberculate swellings; the expanded supra-coxal angle with a fairly strong, conical spine that is accompanied by a small tubercle at the base; metapleural low, conical. Mesosternum weakly tri-carinate with only the medio-longitudinal keel acute and the lateral carinae rather faintly indicated and medially supplied with 3–4 low mesosternals that are marked by black spots (Fig. 36K). Metasternum only with a weakly indicated medio-longitudinal carina (Fig. 36C).

Abdomen. – Median segment distinctly transverse, pentagonal and obtusely keeled medio-longitudinally. Segments II-VII all distinctly transverse and slightly gradually narrowing with II about 2x and VII only 1.6x wider than long. Terga all with two weakly indicated, closely spaced medio-longitudinal carinae that are marked by low granules, which are more decided on VII than on preceding; II-IV with a strong, spinose pair of second posteriors, which are merely represented as low tubercles V. Sterna II-VII rather smooth but weakly tectate with a shallow medio-longitudinal keel; V-VII with a pair of low, converging bulges that terminate in an obtuse swelling posteriorly on VII (Fig. 36J). Terga VIII-X narrowing; the two medio-longitudinal carinae more distinct than on preceding terga and posteriorly terminating in a triangular, dentiform protrusion (Fig. 36H-I). Anal segment trapezoidal in outline, declining with a distinct medio-longitudinal keel and anteriorly with a pair of obtuse, verrucose nodes; the lateral margin obliquely convergent in posterior half and the posterior margin rather angular (Fig. 36H-I). Epiproct convex with a faint indication of a medio-longitudinal carina, weakly convergent and the apex flattened and obtusely rounded to roundly angular (Fig. 36I). Subgenital plate navicular, distinctly carinate apically and progressively narrowing towards a pointed apex, that very slightly surpasses the epiproct (Fig. 36J).

Legs. – Long and slender for the genus with weakly developed armature; tibiae wholly unarmed except for 3-4 minute, dentiform swellings on ventral carinae. Pro- and mesofemora notably shorter than mesothorax, metafemora slightly surpassing posterior margin of abdominal segment V and metatibiae almost attaining tip of subgenital plate. Basitarsi rather elongate if compared to congenerics and about as long as following three tarsomeres taken together.

Measurements [mm]. – Body 54.5-58.0, pronotum 4.3-4.6, mesonotum 10.0-12.0, metanotum 4.2-4.5, median segment 2.6-2.8, profemora 9.5-11.8, mesofemora 8.2-10.0, metafemora 11.0-13.7, protibiae 9.4-11.5, mesotibiae 8.4-9.8, metatibiae 12.4-14.0, antennae 17.2-19.5.

Variability. – The few available specimens show considerable morphological variability in both sexes, especially concerning the body spination. The ♂ holotype from Polillo (Fig. 37G-H) is smaller (36.0 mm) and slightly stockier than the specimens from Luzon, but very well matches with these in basically all other aspects. The ♂ (body length 38.5 mm) from an unknown locality in the collection of NHMUK corresponds to the Luzonian specimens in shape and with the holotype in aspect of the head and body armature. Both specimens have only the meso- and metapleurals distinct and represented as spines, whereas the mesopleurae are otherwise only supplied with three slightly enlarged tubercles (Fig. 37A). The two ♂ in RBINS differ considerably from each other in aspect of the mesopleural armature. While the example from Sierra Madre has the spines along the lateral margin of the mesopleurae strongly developed and represented as long, slender spines (Fig. 37B), these are merely small tubercles in the example from Nagtipunan (Fig. 37A) and the holotype (Fig. 37G). Moreover, the latter specimen also has the second paired posterior spines of abdominal terga II-III much less developed (Fig. 37C), but all the other elements of head and body armature are essentially similar in size and shape to the Sierra Madre specimen. Even slight variability is seen in the relative length of the elongate triangular mesonotal area, which is slightly more than half of the length of the mesonotum in the holotype (Fig. 37G) and example from Nagtipunan (Fig. 37B), but a little less than half as long as the mesonotum in the other two specimens (Fig. 37A). The range of body length in ♂ is 36.0-44.8 mm and a full set of measurements for the two specimens in RBINS is given below. Similar variability is seen in the ♀, with the two mesopleural laterals only strongly developed in the example from Dingalan in the authors collection (Fig. 36E) but merely represented as rather small, spiniform tubercles in the two other specimens (Fig. 36A). Notable variability can also be observed in the shape of the pronotal anteriors, which are distinctly 4-spinose in the example from Dingalan (Fig. 36M) but have a notably more enlarged anterior spine that is followed by a gap and a variable number of much smaller spines in the other two ♀ (Fig. 36L).
Measurements of ♂ from Luzon [mm]: Body 42.0-44.8, pronotum 3.4-3.6, mesonotum 8.3-8.7, metanotum 3.4-3.7, median segment 2.1-2.3, profemora 8.2-9.0, mesofemora 7.0-8.0, metafemora 9.7-10.2, protibiae 8.2-9.1, mesotibiae 7.1-7.7, metatibiae 10.0-10.8, antennae 15.0-16.5.

Egg (Fig. 46S-T)

The only available egg in the authors collection (FH No. 1182-E), that was extracted from the ovipositor of the ♀ from Dingalan, is contaminated and shows anomalies in the colouration, having a large and irregularly shaped ochre marking ventro-laterally. This marking is also less sculptured than the rest pf the capsule and careful cleaning could not remove all of the contamination.
Fairly small for the genus; capsule barrel-shaped with dorsal surface much more bulgy than ventral surface and the polar-area with a shallow indention; oval in cross-section and higher than wide; capsule slightly more than 1.5x longer than wide. The anterior portion with a slight constriction just below the somewhat swollen anterior margin. Surface minutely granular and all over unevenly rugulose with some of the rugulae somewhat tubercular in shape. Micropylar plate fairly large and over 0.8x as long as capsule; Y-shaped with the median portion broad, roughly parallel-sided and clearly not approaching lower margin of anterior constriction of capsule; the two posterolateral extensions very broad with the interior margin distinctly rounded, narrowing apically and distinctly surpassing axis of egg on lateral surfaces of capsule. Posterior portion narrowly V-shaped with an angle of only about 40° and with a large bowl-shaped micropylar cup in centre. Outer margin of plate obtusely inflated and the entire plate slightly raised from capsule surface; the interior portion somewhat inflated and sculptured like capsule; the narrow space in between slightly indented. Operculum almost round in outline, the outer margin with a slight tubercular collar, then slightly indented and the interior portion weakly convex with a shallow pit in centre; the raised interior area unevenly rugulose. Colour plain mid to dark brown. Measurements [mm]: Length incl. operculum 3.5, length 3.5, width 2.3, height 2.8, length of micropylar plate 2.9.

Fig. **37**. *Tisamenus polillo* (Rehn & Rehn, 1939) ♂.

A. Dorsal view of specimen with weakly developed mesopleurals (from Nagtipunan, Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **B**. Dorsal view of specimen with strongly developed mesopleurals (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **C**. Dorsolateral view of specimen with weakly developed mesopleurals (from Nagtipunan, Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **D**. Dorsolateral view of specimen with strongly developed mesopleurals (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **E**. Lateral view (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **F**. Dorsolateral view of specimen with strongly developed mesopleurals (from Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **G**. HT, dorsal view [ANSP]. **H**. HT, dorsal view [ANSP]. **I**. Terminalia in lateral view. **J**. Terminalia in dorsal view. **K**. Terminalia in ventral view. **L**. Closeup of head, pro- and mesonotum of specimen with weakly developed mesopleurals (from Nagtipunan, Quirino Province, Sierra Madre, E-Luzon) [RBINS]. **M**. Closeup of head, pro- and mesonotum of specimen with distinct mesopleurals (from Nagtipunan, Quirino Province, Sierra Madre, E-Luzon) [RBINS].

Remarks. – The ♀ and egg are here described and illustrated for the first time.

Distribution. – Polillo [USNM – type locality]. E-Luzon: Province Quirino (Sierra Madre [RBINS]; Nagtipunan Municipality [RBINS]); Province Aurora (Sierra Madre, Dingalan 230 m [RBINS]). Central Luzon: Province Laguna (Santa Rosa [FH]). N-Luzon: Province Kalinga (Pinukpok [RBINS]). "Philippine Islands" [NHMUK].

Tisamenus ranarius (Westwood, 1859)

(Fig. 38)

Acanthoderus ranarius Westwood, 1859: 53, pl. 4: 3 (♀).

HT, ♀: Phil. Isl.,54 76; *Acanthoderus ranarius* Westw. Philippine Isl.; *ranarius*; Holotype; BMNH(E) #845221 [NHMUK].

Tisamenus ranarius, Kirby, 1904: 399.

- Zompro, 2004: 207.
- Otte & Brock, 2005: 335.
- Brock *et al.,* 2016: 191. (Type data)
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Heterocopus ranarius, Redtenbacher, 1906: 42.

- Bruner, 1915: 229.

Ilocano ranarius, Rehn & Rehn, 1939: 463.

Material examined

1 ♀: Manilla; *Acanthoderus Ranarius* W. pl. 4: 3 [UMO, No. 495];

1 ♀: Filipinas, Mazarredo; *Heterocopus ranarius* West. [MNMS];

1 ♀: Philippinen, Luzon Island, Prov. Laguna, Santa Rosa, local collector VII. 2004 [coll. FH, No. 1551-1].

Differentiation. – Females (Fig. 38) of this small but distinctive species (the only sex known) are morphologically very close to those of *T. trapezoides* **n**. **sp**. with which they share the dentiform apical protrusion on the exterior lateral carina of the scapus (Fig. 38I-J), remarkably reduced and almost indiscernible triangular mesonotal area (Fig. 38J) and sub-spiniform postero-laterals of the abdominal terga. All three characters distinguish both species from all other congenerics and are likely to represent autapomorphies of two sister taxa. These ♀ are however easily distinguishable from those of *trapezoides* by the comparatively less widening meso- and metathorax, just weakly and obtusely granular lateral margins of the meso- and metapleurae (tubercular in *trapezoides*), smaller and merely obtusely tubercular metapleural (sub-spinose in *trapezoides*), much smaller and obtusely rounded sub-orbitals (Fig. 38J), less definite triangular area of the pronotum, notably shallower and broader medio-longitudinal bulge of the dorsal body surface, notably more defined longitudinal carinae of the mesosternum (Fig. 38I), considerably less developed armature of the limbs (metafemora in particular) and having the tibiae coloured like the corresponding femora (contrastive ochre to clay coloured in *trapezoides*).

Variability. – Body length of ♀ 42.0-42.2 mm.

Remarks. – Westwood (1859: 53) originally described *Acanthoderus ranarius* from a unique ♀ from an unspecified locality in the collection of NHMUK (Fig. 38E). Although there is a further ♀ in the collection of UMO, which is most likely to have been examined by Westwood, this is not regarded as a paratype because Westwood did not mention any specimens other than the ♀ in NHMUK. Luckily, the UMO specimen bears a label that states "Manilla" and thereby proves *ranarius* to be from the island of Luzon. The specimen in the author's collection serves another definite record of *ranarius* from Luzon, but the ♂ as yet remains unknown. The holotype in NHMUK bears an egg in its ovipositor, which however could not be extracted for the present study (Fig. 38F). The generic position of this species has been interpreted differently in the past, which was perhaps due to the tiny triangular mesonotal area, that is almost undiscernible and distinguished this species from all other congenerics. Redtenbacher (1906: 42) allocated it to the genus *Heterocopus* Redtenbacher, 1906 and Rehn & Rehn (1939: 463) affiliated it to *Ilocano* Rehn & Rehn, 1939, which however was shown to be a synonym of *Tisamenus* (Bank et al., 2021). The apparent close affinity to *T. deplanatus* (Westwood, 1848) and *T. cervicornis* Bolívar, 1890 leaves no doubt that *ranarius* is a member of *Tisamenus*.

Distribution. – Philippines [NHMUK – type locality; MNMS]). Luzon: Province Quezon (Manila [OUM]); Province Laguna (Santa Rosa [FH]).

Tisamenus serratorius Stål, 1875

(Fig. 39-40, 46U-V)

Tisamenus serratorius Stål, 1875. 92.

HT, ♀: Coll. Br. v. W., Philippinen, Thorey ded.; det. Redtenb. *Tisamenus serratorius*; 3012. [NHMW, No. 38].

- Kirby; 1904: 399.
- Redtenbacher, 1906: 43.
- Bruner, 1915: 230.
- Zompro, 2004: 207.
- Otte & Brock, 2005: 335.
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Hoploclonia serratoria, Rehn & Rehn, 1939: 472. (*Serratoria* Group)

Hoploclonia serratorius, Brock, 1998: 57. (Type data)

[**Not**: *Tisamenus serratorius*, Krijns, 2011: 7, Figs. (Notes on rearing), misidentification. This is *T. lachesis* (Rehn & Rehn, 1939)]

[**Not**: *Tisamenus serratorius*, Harman, 2015: 26. (Notes on PSG culture stock), misidentification. This is *T. lachesis* (Rehn & Rehn, 1939)]

[**Not**: *Tisamenus serratorius*, Dräger, 2012: 12, Fig. 16-17, misidentification. This is *T. lachesis* (Rehn & Rehn, 1939)]

Material examined

3 ♀, **4** ♂, **1** ♀ (immature), **2** eggs: Philippinen, W-Luzon Island, Prov. Nueva Ecija, Gabaldon Munip., Mingan Mts., local collector 2013 [FH, No's 1525-1 to 8 & E].

Differentiation. – The ♀ of this species is morphologically most similar to *T. lachesis* (Rehn & Rehn, 1939) and *T. clotho* (Rehn & Rehn, 1939) but easily separated from both species by having six instead of five mesopleural spines. From *lachesis* it can also be differentiated by the much smaller size and stockier shape, relatively shorter mesonotum, larger triangular mesonotal area, which covers notably more than half the length of the mesonotum (Fig. 39J), generally much less developed and more obtuse cephalic spines and body armature, as well as the shorter subgenital plate, that scarcely projects beyond the tip of the epiproct (Fig. 39G-I). From *clotho* it may also be distinguished by the slightly slenderer shape, somewhat longer mesonotal triangular area, which notably surpasses the middle of that segment and has the outer margins gently convex with the anterolateral angles somewhat less protruded than in *clotho* (Fig. 39J) as well as the generally less developed spines of the head and body and having the meso- and metapleural spines relatively stronger and less acutely pointed than in *clotho*. Based on the ♀ only, Rehn & Rehn (1939: 473) suggested close affinity to *T. asper* Bolivar, 1890 with which *serratorius* shares having six mesopleural spines. However, these spines as well as the metapleurals are much larger in *serratorius* and this species is notably slenderer in general shape and has a conical spinose pair of posteriors on abdominal terga II-IV (Fig. 39D). By having six mesopleural spines the ♂ of *serratorius* keys out similar to *T. heitzmanni* **n**. **sp**. from the island

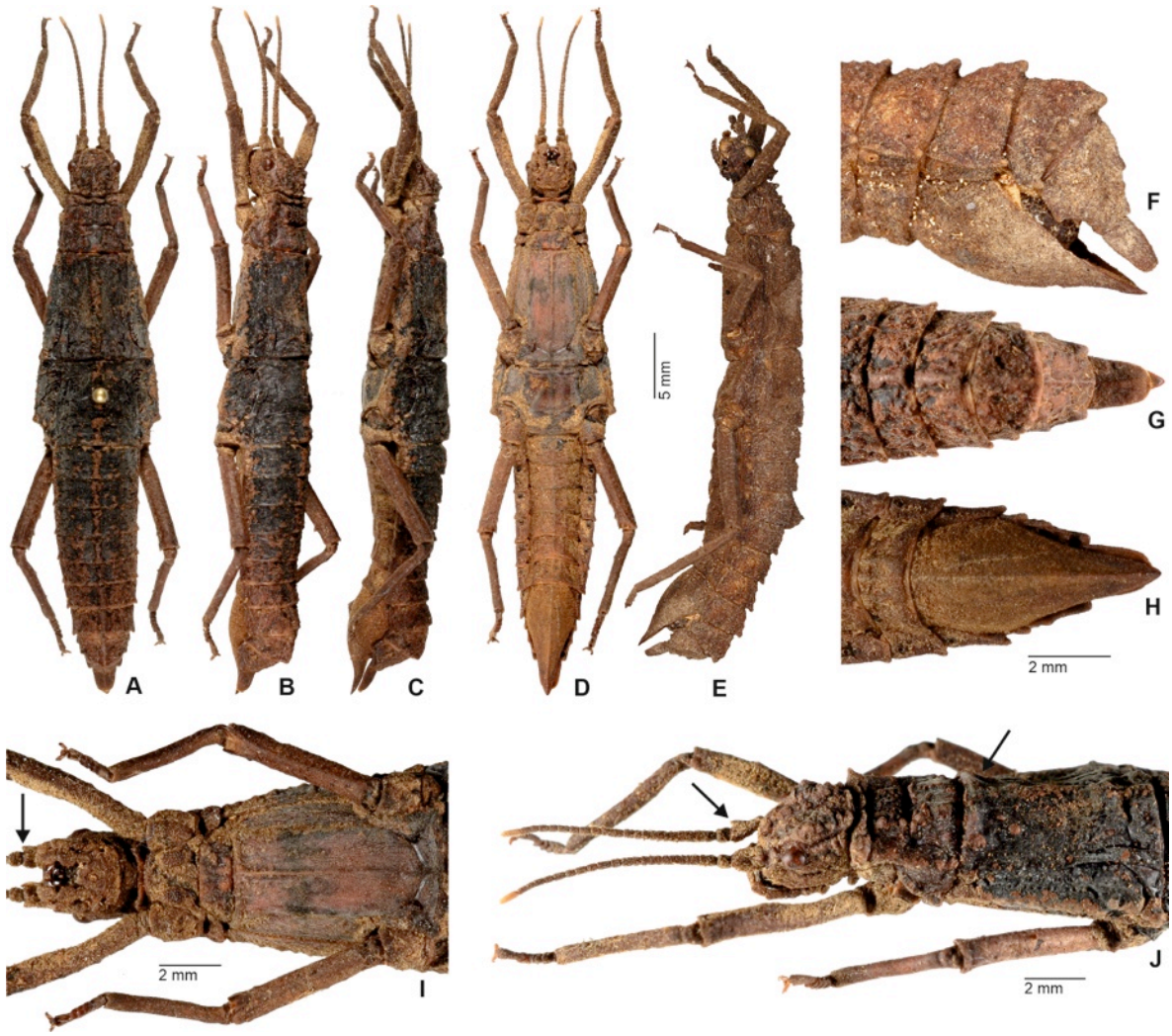

Fig. **38**. *Tisamenus ranarius* (Westwood, 1859) ♀ from Santa Rosa, Laguna Province, Luzon [FH 1551-1].

A. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view. **D**. Ventral view. **E**. Lateral view of HT [NHMUK © Paul D. Brock]. **F**. Terminalia of HT in lateral view [NHMUK © Paul D. Brock]. **G**. Terminalia in dorsal view. **H**.Terminalia in ventral view. **I**. Closeup of head, pro- and mesosternum (arrow pointing to the dentiform apical protrusion on the exterior lateral carina of the scapus). **J**. Closeup of head, pro- and mesonotum (arrows pointing to the dentiform apical protrusion on the exterior lateral carina of the scapus and strongly reduced triangular mesonotal area).

of Cebu but otherwise also comes morphologically very close to that of *clotho*. This ♂ however differs from both species by the presence of distinct conical inter-posterior meso- and metanotals (Fig. 40C, I). From the first it may additionally be separated by the much slenderer shape and having the abdominal terga III-VI rather quadrate than transverse like in *heitzmanni*, the much shorter and more obtuse pleural spines and generally less developed body armature, including notably lower tri-spinose anterior pronotals that are gradually decreasing in size from anterior to posterior (Fig. 40I; very large and bi-fid in *heitzmanni* with the posterior element stronger than the anterior one) as well as much lower obtuse anterolateral angles of the mesonotal triangular area (Fig. 40I; a large upright spine in *heitzmanni*). From *clotho* this ♂ also differs by the slenderer shape but less expanded mesothorax in particular, which is sub-parallel sided and not roundly broadened as in *clotho*, the longer mesonotal triangular area, which notably surpasses the middle of the mesonotum (Fig. 40I), and more distinct ventral teeth of the metatibiae (Fig. 40E). The eggs of *serratorius* (Fig. 46U-V) most closely resemble those of *T. napalaki* **n**. **sp**. and *T. spadix* (Rehn & Rehn, 1939) with which they share the strongly developed, raised mesh-work work of verrucose ridges of the capsule. They can however be differentiated from both by the dark almost black overall colouration and noticeably larger micropylar plate, which is 0.8x as long as the capsule with the median portion almost approaching the anterior margin and the posterolateral extensions laterally surpassing the axis of the capsule.

Description

♀ (Fig. 39)

Form and colouration. – Size rather small for the genus (body length 46.0–55.5 mm); general form stocky with the elements of armature well developed and the mesopleurae with six strong spines. Colour greyish chestnut brown with some darker areas on thorax and the femora; meso- and metasternum, most of tibiae and all ventral teeth of femora buff. All the larger spines of thorax and abdominal terga dark brown with orange tips. Antennae mid brown with the terminal five joints ochre. Holotype generally fuscous with some dark ochraceous areas.

Head. – Sub-quadrate, just a little longer than wide with genae parallel-sided; supra-orbitals fairly prominent, conical and accompanied by a small tubercle in front and behind; occipitals small, tubercular; coronals somewhat more pronounced, conical tubercular and the median coronals occasionally weakly bifid (Fig. 39J). Genae supplied with 2-3 low, granular gulars. Eyes rather small, sub-globose and their diameter corresponding to somewhat less than half the length of gena. Antennae moderately strong, reaching to tip of protarsi and with 26 segments; scapus roundly triangular with interior margin rounded apically; pedicellus about half as long as scapus, round in cross-section and with a nodose dorsolateral basal swelling; III a little longer than pedicellus, IV much shorter and the following up to XIV somewhat increasing, the following decreasing in length; terminal antennomere elongated and about as long as two preceding joints taken together.

Thorax. – Pronotum sub-trapeziform, the triangular area just weakly indicated and only marked by low tubercles in the post-sulcal area; anteriors represented by rather strong, trifid, sub-spinose tubercles (Fig. 39J).

Fig. 39. *Tisamenus serratorius* Stål, 1875 ♀ [**C-K** coll. FH].

A. HT, dorsal view [NHMW © Paul D. Brock]. **B**. HT, lateral view [NHMW © Paul D. Brock]. **C**. Dorsal view [FH 1525-1]. **D**. Dorsolateral view [FH 1525-1]. **E**. Lateral view [FH 1525-1]. **F**. Ventral view [FH 1525-1]. **G**. Terminalia in lateral view. **H**. Terminalia in dorsal view. **I**. Terminalia in ventral view. **J**. Closeup of head, pro- and mesonotum. **K**. Closeup of head, pro- and mesosternum.

Mesothorax broad, somewhat widening towards the posterior with the lateral margins of pleurae weakly rounded; about 2x longer than prothorax. Mesonotum almost rectangular with the posterior half slightly but abruptly narrowed, 1.8x longer than width at anterior margin; triangular area reaching to middle of notum, slightly longer than width over anterolateral angles, the weakly arched convergent lateral margins granulate and the anterolateral angles obtusely tubercular (Fig. 39J). Posterior portion with a distinct medio-longitudinal carina that is well continued throughout the whole length of the triangular area; surface of keel granular and with a pair of low nodes pre-posteriorly. Mesopleurae strongly expanded and armed with five strong laterals, the anterior one of which is small and tubercular and the remaining fours spinose; mesopleural strong, spinose and scarcely shorter than the four large laterals; supra-coxal small, tubercular. Metanotum weakly trapeziform, about 0.45x length of mesonotum and with the medio-longitudinal keel like in mesonotum. Metapleurae with two sub-spiniform laterals and the expanded supra-coxal angle with a strong, conical and bifid metapleural, whose posterior spike is much smaller; supra-coxal low, conical. Mesosternum distinctly tri-carinate with the medio-longitudinal keel acute and the lateral carinae somewhat irregular and medial of these about three low, rounded mesosternals that are marked by black dots (Fig. 39K); metasternum only with a weakly indicated medio-longitudinal carina (Fig. 39F).

Abdomen. – Median segment transverse with anterior margin broadly rounded; medio-longitudinal keel obtuse and posterior margin with a transverse series of low granules. Segments II-VII all distinctly transverse with II-IV roughly uniform in width and V-VII progressively narrowing; II almost 2.5x and VII only about 2x wider than long. Terga II-VI with a slight indication of two closely spaced medio-longitudinal carinae, these more pronounced in VIII-IX, fused and terminating in a conical posterior swelling (Fig. 39G-H); II-IV with a strong and spinose pair of second paired posteriors, which are present but merely represented by tubercles on V. Sterna II–VII with a weakly indicated medio-longitudinal line; praeopercular organ formed by a widely spaced pair of low swellings at posterior margin on VII (Fig. 39I). Terga VIII-X progressively narrowing, IX strongly tectate longitudinally. Anal segment obliquely declining

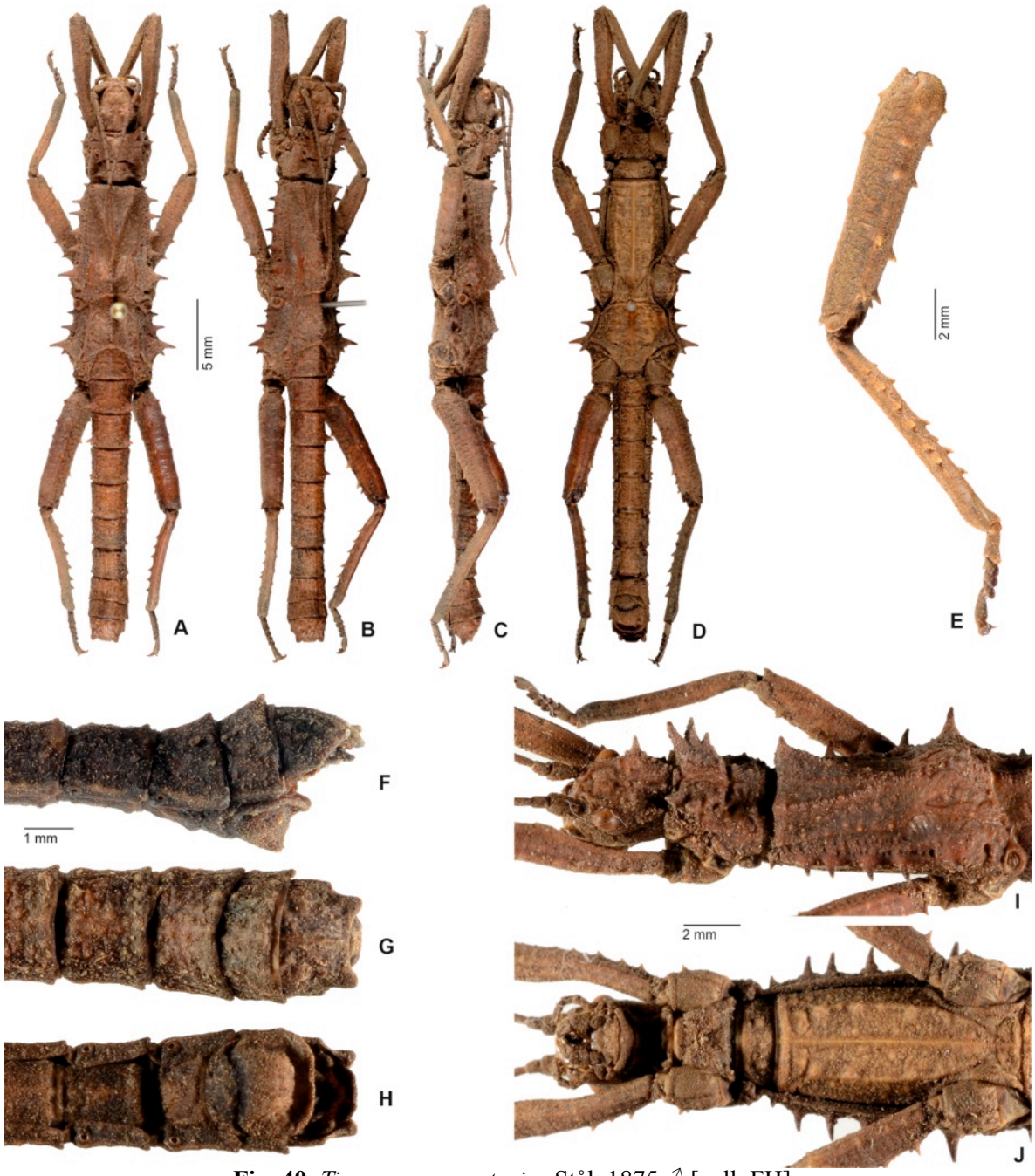

Fig. **40**. *Tisamenus serratorius* Stål, 1875 ♂ [coll. FH].

A. Dorsal view [FH 1525-6]. **B**. Dorsolateral view [FH 1525-6]. **C**. Lateral view [FH 1525-6]. **D**. Ventral view [FH 1525-6]. **E**. Anteroventral view of right hind leg. **F**. Terminalia in lateral view. **G**. Terminalia in dorsal view. **H**. Terminalia in ventral view. **I**. Closeup of head, pro- and mesonotum. **J**. Closeup of head, pro- and mesosternum.

with a distinct medio-longitudinal keel and anteriorly with a pair of obtuse nodes, the lateral margin obliquely convergent in posterior half and the posterior margin very weakly rounded (Fig. 39H). Epiproct convex with a faint indication of a medio-longitudinal carina, weakly convergent and the apex obtusely rounded to roundly angular (Fig. 39H). Subgenital plate navicular, distinctly carinate apically and gradually narrowing towards a rather pointed apex, that slightly surpasses the epiproct (Fig. 39I).

Legs. – Of average shape for the genus with armature moderately developed; profemora scarcely and mesofemora notably shorter than mesothorax, metafemora reaching about halfway along abdominal segment V and metatibiae almost reaching posterior of anal segment. Basal dorsal tooth and the two apical ventral teeth of meso- and metafemora more spinose than others. Pro- and mesotibiae destitute of teeth; metatibiae with 6-7 small but uniformly sized teeth on ventral carinae. Basitarsi short, a little shorter than following three tarsomeres taken together.

Measurements of ♀ in coll. FH [mm]. – Body 54.0-55.5, pronotum 3.9-4.0, mesonotum 9.9-10.1, metanotum 4.5–4.6, median segment 3.0, profemora 9.7-9.8, mesofemora 8.0-8.4, metafemora 10.1-11.3, protibiae 9.7-9.9, mesotibiae 8.8-9.1, metatibiae 12.8-13.2, antennae 27.5-28.0. Body length of the holotype ♀ 46.0 mm.

♂ (Fig. 40)

Form and colouration. – Size average for the genus (body length 39.0–40.5 mm), general form fairly slender and elongate, the elements of armature essentially like in ♀ but comparatively more developed; the legs broader and stouter with the metafemora somewhat incrassate and thickened towards the base. Colour like in ♀. The terminal twelve antennomeres russet (terminal joint ochre) and glossier than rest of antennae.

Head. – Like in ♀ but supra-orbital notably longer, slenderer and spinose and the eyes proportionately larger with their diameter corresponding to about 0.55x the length of gena (Fig. 40I). Antennae only with 24 segments with all joins proportionally longer; almost reaching to tip of protarsi.

Thorax. – Pronotum essentially as in ♀ but less trapeziform in outline and the trifid anterior noticeably longer, spinose with the anterior spine

distinctly projecting over anterior margin of notum (Fig. 40I). Meso- and metanotum gibbose, conical and distinctly bi-nodose posteromedially (Fig. 40C, I). Mesothorax 2.2x longer than prothorax and slightly progressively widening towards posterior. Mesonotum with lateral margins slightly convergent in anterior half, then followed by a distinct concave indention and in the gibbose posterior portion somewhat rounded, about 2.1x longer than width at anterior margin; the triangular area notably longer than in ♀, about 0.6x the length of mesonotum and 1.4x longer than width across anterolateral angles; the convergent lateral margins granular and the anterolateral angles obtusely sub-spiniform; posterior portion with a distinct, granular medio-longitudinal keel, that is notably continued throughout most of the triangular area Fig. 40I). Mesopleurae like in ♀, but all elements of armature comparatively slenderer and more acutely pointed. Metanotum sub-trapeziform in outline, noticeably longer than wide and with the same medio-longitudinal bulge seen on mesonotum. Metapleurae essentially as in ♀, but with all spines relatively larger. Mesosternum like in ♀, but with the mesosternals obtuse (Fig. 40J); metasternum only with a weakly indicated medio-longitudinal carina (Fig. 40D).

Abdomen. – Median segment almost semi-circular in outline, the medio-longitudinal carina just weakly indicated. Segments II-VII almost uniform in length and width, II sub-trapeziform and III-VII sub-quadrate; the second paired posteriors represented by strong but short spines on II-III, sub-spiniform tubercles on IV and merely by nodes on V. An indication of a shallow medio-longitudinal carina visible throughout entire length of dorsal surface of abdomen, but most prominent and posteriorly terminating in an obtuse triangular swelling on VIII and IX (Fig. 40F). Sterna II-VII with a fine but definite medio-longitudinal carina. Terga VIII and IX notably transverse and shorter than all preceding segments. Anal segment somewhat declining towards the posterior, the lateral margins obliquely angular and the posterior portion narrowed with the margin shallowly emarginated and the outer angles obtusely protruded (Fig. 40G). Epiproct broadly transverse, weakly rounded and roughly reaching to posterolateral protrusions of anal segment (Fig. 40G). Vomer broad, hear-shaped, slightly asymmetrical with the short but strong terminal hook somewhat displaced dextrally; the basal portion shallowly indented and with some weakly indicated transverse furrows. Poculum deeply cup-shaped with an obtusely angular central protrusion at the angle (Fig. 40F); the posterior flange roundly angular and weakly bi-labiate and slightly down-curved (Fig. 40H).

Legs. – All teeth comparatively more developed than in ♀. Profemora about as long and mesofemora slightly shorter than mesothorax, metafemora reaching to posterior of abdominal segment V and metatibiae roughly attaining tip of abdomen. Ventral teeth more spiniform than those on dorsal carinae, the two apical ventral teeth of metafemora in particular notably more pronounced than all others. Ventro-basal swelling of metafemora roundly gibbose and smooth (Fig. 40E). Ventral carinae of metatibiae each with about 6-8 strong teeth, that are relatively larger than in ♀ (Fig. 40E). Tarsi like in ♀.

Measurements [mm]. – Body 39.0-40.5, pronotum 3.6-3.7, mesonotum 7.2-7.5, metanotum 3.4-3.7, median segment 1.8-1.9, profemora 8.0-8.1, mesofemora 6.6-6.8, metafemora 9.3-9.7, protibiae 7.2-7.4, mesotibiae 6.8-7.0, metatibiae 8.9-9.2, antennae 13.0-13.5.

Variability. – The ♀ holotype is smaller than the other samples at hand (46.0 mm) and differs from these by the somewhat darker colour and slightly less developed cephalic and thoracic armature, which concerns to supra-orbitals and pronotal anteriors in particular. The specimens from Mingan Mountains in the authors collection show no noteworthy variability.

Egg (Fig. 46U-V)

Of moderate size for the genus; capsule ovoid with the dorsal surface more bulgy than ventral surface; capsule 1.56x longer than wide. Surface minutely granulose, very slightly shiny and all over covered by an uneven raised network of verrucose ridges; the lots between the ridges slightly larger and more regular below anterior margin of capsule. The anterior margin somewhat inflated and verrucose. Micropylar plate large and about 0.8x as long as capsule; rather narrowly Y-shaped with the median portion large, almost uniform in width and almost approaching anterior margin of capsule; the two posterolateral extensions slightly widened medially and tapered apically, tip notably surpassing the axis of the egg if seen laterally. Posterior portion 110° and V-shaped with a bowl-shaped micropylar cup in centre that has an obtuse tubercle above. Outer margin of plate somewhat raised and sculptured like the verrucose ridges of the capsule, the interior portion raised and densely but unevenly verrucose and the moderately broad somewhat rim in between the outer margin and sculptured inner portion of the plate smooth. Median line indistinct and seen to be a shallowly raised and rather short carina. Operculum almost circular in outline; near the outer margin with a collar of short peg-like or fringy protuberances and interiorly with a broad rim of similar excrescences; both connected by a few very fine irregularly radial directed carinae. Central portion smooth with a small tubercle in centre. Colour plain blackish brown with all the raised parts slightly lighter brown to buff. Measurements [mm]: Length incl. operculum 3.7, length 3.6, width 2.3, height 2.8, length of micropylar plate 3.0.

Remarks. – Stål (1875: 92) described this rather small species from a unique ♀ in the collection of NHMW. The holotype is in good condition except for having the right lateral portions of abdominal segment II-VII destroyed by parasites and lacking the tips of both antennae as well as the right metatarsus. So far, the species has not again been recorded and the examples in the author's collection provide the first definite locality. Rehn & Rehn (1939: 473) had not examined Stål's specimen, hence due to the fairly brief descriptions provided by Stål (1875) and Redtenbacher (1906: 43) were not able to interpret the species correctly and suggested close affinity to *T. asper* Bolivar, 1890. All references to cultured specimens are misidentifications and do not represent *T. serratorius* but *T. lachesis* (Rehn & Rehn, 1939) instead (e. g. Dräger, 2012: 12).

Distribution. – "Philippines" [NHMW – type locality]. W-Luzon: Province Nueva Ecija (Gabaldon, Mingan Mountains [FH]).

Tisamenus spadix (Rehn & Rehn, 1939)
(Fig. 41-42, 46W-X)

Hoploclonia spadix Rehn & Rehn, 1939: 478, pls. 31: 9 (♀), 32: 18 (♂).

HT, ♂: N. W. Panay, Baker; *Hoploclonia spadix* Rehn & Rehn, Type #.1346; Data Base Serial No. Assigned as Type No. September 2008. Type #9128 [ANSP];

PT, ♀ (penultimate instar): Culasi, Panay, Philippines; V.24.1918, R.C. McGregor; *Hoploclonia spadix* Rehn + Rehn Allotype, Paratype; Data Base Serial No. Assigned as Type No. September 2008. Type No. #9128 [ANSP].

- Otte, 1978: 79. (Type data)

Tisamenus spadix, Zompro, 2004: 207.

- Otte & Brock, 2005: 335.
- Hennemann *et al.,* 2016: Figs. 62 (♀), 63 (♂), 71-a-c (egg).
- Brock & Büscher, 2022: 521.
- Hennemann, 2023b: 128.

Material examined

2 ♀, **2** ♂, **2** ♀ (juveniles), **1** egg: Philippinen, Panay Island, Mount Nangtud 500 m, leg. N. Mohagan 12.-13.III.1996 [FH, No's 0271-1 to 6 & E].

Differentiation. – This very distinctive species was placed in the *Deplanatus* group by Rehn & Rehn (1939) and apparently it is morphologically closest *to T. deplanatus* (Westwood, 1859) and *T. cervicornis* Bolívar, 1890. However, this species has all the elements of armature of the head, body and limbs much more developed, which in particular concerns to the huge bi-spinose anterior pronotals which project notably over the anterior margin of the pronotum, and pair of strong posteriors on abdominal terga II-VI (smaller and missing on V-VI in *deplanatus* and *cervicornis*), and having a distinct spiniform production externally on the metacoxae (Fig. 41C, 42E). Moreover, the metapleural is produced into two equally sized spiniform projections, whereas these are unequal in *deplanatus* and *cervicornis* with the dorsal element larger. Females (Fig. 41A-C) have the mesonotal triangular area scarcely longer than wide, thus notably shorter than in *deplanatus* but proportionally longer than in *cervicornis*, and in contrast to these two species its disc is distinctly and evenly concave with the outer carinae

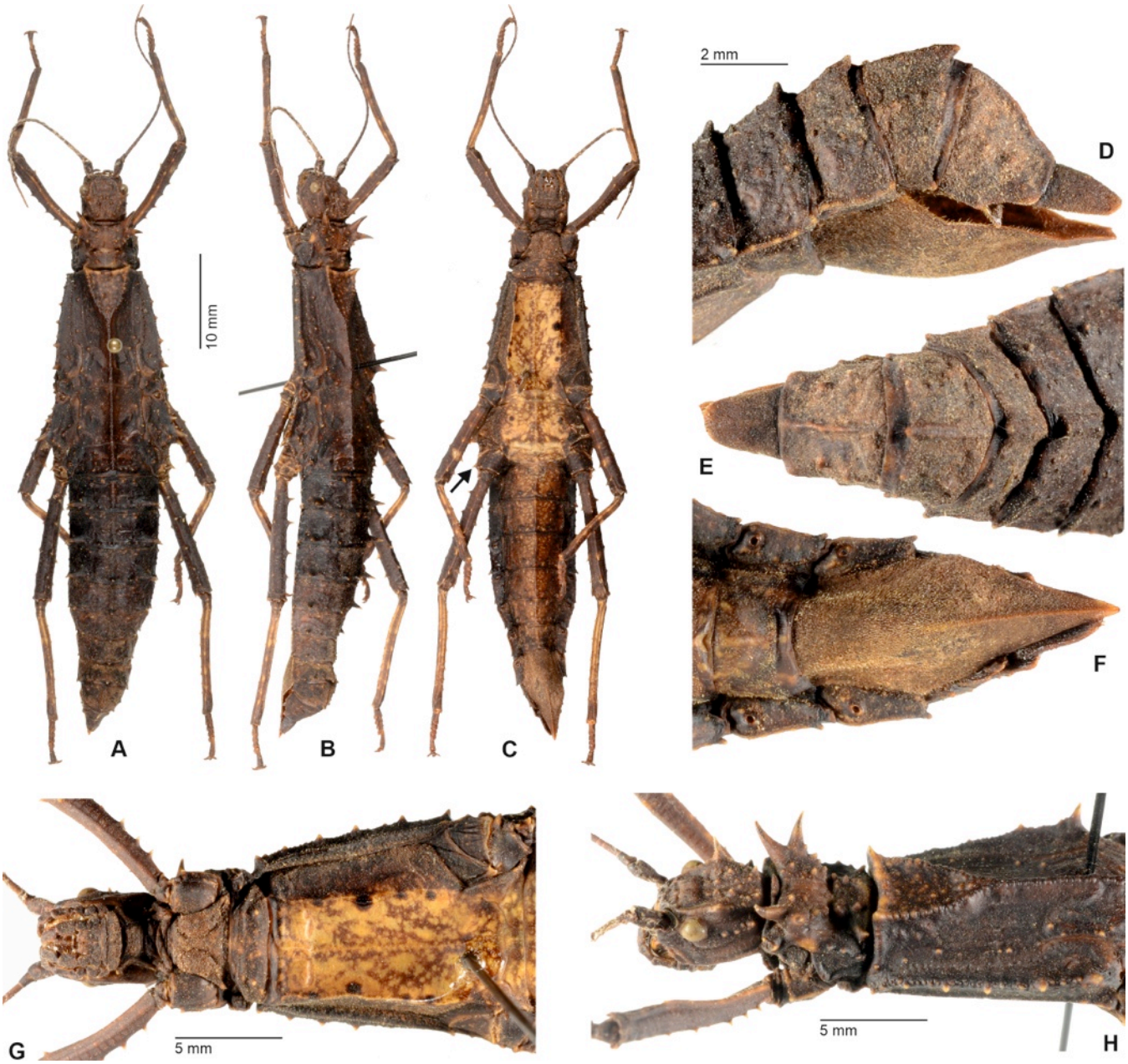

Fig. **41**. *Tisamenus spadix* (Rehn & Rehn, 1939) ♀ [FH 0271-2].

A. Dorsal view. **B**. Dorsolateral view. **C**. ventral view (arrow indicating the exterior metacoxal spine). **D**. Terminalia in lateral view. **E**. Terminalia in dorsal view. **F**. Terminalia in ventral view. **G**. Closeup of head, pro- and mesosternum. **H**. Closeup of head, pro- and mesonotum.

weakly arched (Fig. 41H). Males (Fig. 42A-E) are easily separated from *deplanatus* and *cervicornis* as well as from all other similar species by the much more incrassate femora (Fig. 42H) and the large, backward-arched spine at the anterior angles of the mesonotal triangular area (Fig. 42F). The eggs (Fig. 46W-X) are most similar to those of *cervicornis* but differ by the more narrow and less dense network of fringy ridges of the capsule as well as the shorter and broader anterior extension of the micropylar plate.

Egg (Fig. 46W-X)

Fairly large for the genus; capsule ovoid with the dorsal surface notably more bulgy than ventral surface and with a slight narrowing just below anterior margin; capsule 1.48x longer than wide. Surface minutely granulose, slightly shiny and all over covered by an uneven raised network of granular ridges; the lots between the ridges largest and most regular below anterior margin of capsule. The anterior margin somewhat inflated and tubercular. Micropylar plate fairly short and rather T-shaped with the posterolateral extensions equal in length to median portion and extending by an angle of almost 90°, length only about 0.55x as long as capsule. The median portion just slightly surpassing mid of egg capsule and the posterolateral extensions almost reaching to ventral egg surface. Outer margin raised and granular, the interior area of the plate with a similar but much narrower meshwork of granular ridges. Posterior portion almost straight with a large knob-like micropylar cup in centre. Median line indistinct and very short. Operculum almost circular in outline; near the outer margin with a collar of fairly long-fringy protuberances and interiorly with a high rim of fringe-like excrescences; both connected by a few very fine irregularly radial directed carinae. Colour plain ochraceous to pale orangey brown with all the raised parts and fringes contrasting dark brown. Measurements [mm]: Length incl. operculum 4.2, length 4.0, width 2.7, height 2.9, length of micropylar plate 2.2.

Remarks. – Illustrations of both sexes and the egg were provided by Hennemann *et al.* (2016, figs. 62,63, 71a-c). Since the morphology of the adult ♀ essentially corresponds to that of the penultimate instar nymph described in detail by Rehn & Rehn (1939: 480) no redescription but only detailed illustrations of the adult insect are presented herein (Fig. 41A-H). The egg is documented photographically and described formally above. Body lengths ♀ 59.0-61.5 mm, ♂ 37.0-42.5 mm.

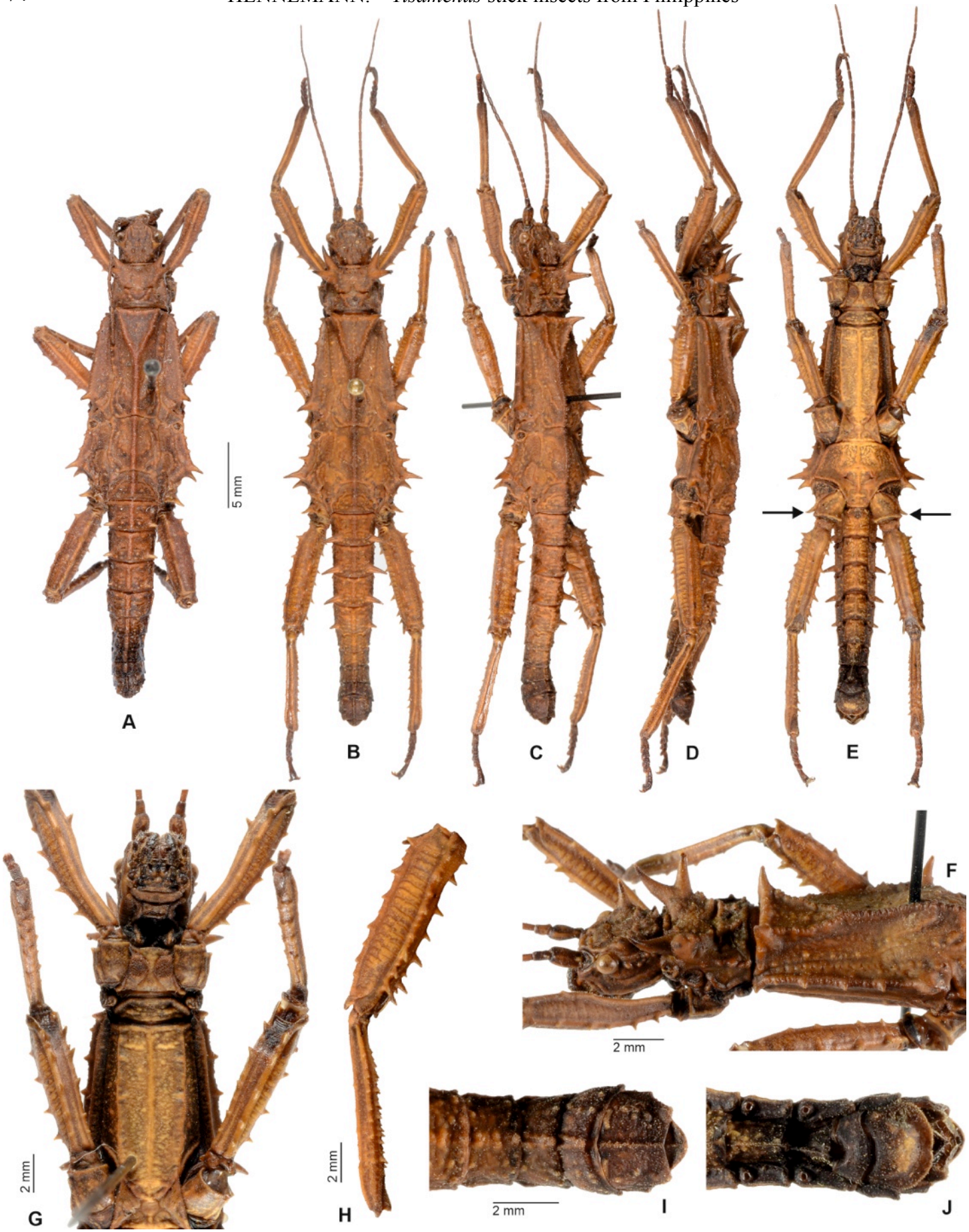

Fig. **42**. *Tisamenus spadix* (Rehn & Rehn, 1939) ♂ [**B-J** coll. FH 0271-3].

A. HT, dorsal view [ANSP]. **B**. Dorsal view. **C**. Dorsolateral view. **D**. Lateral view. **E**. Ventral view (arrows pointing to the exterior metacoxal spine). **F**. Closeup of head, pro- and mesonotum. **G**. Closeup of head, pro- and mesosternum. **H**. Anteroventral view of right hind leg. **I**. Terminalia in dorsal view. **J**. Terminalia in ventral view.

Distribution. – Panay, endemic. Northwest Panay [ANSP – type locality]); Province Antique (Culasi [ANSP]; Mount Nangtud [FH]; Sebaste, Alegre [photographic record: https://inaturalist.ca/observations/181791590]); Province Aklan (Malay, near Dumlog [photographic record: https://www.inaturalist.org/observations/182627542].

Tisamenus summaleonilae Lit & Eusebio, 2005

Tisamenus summaleonilae Lit & Eusebio, 2005: 212, Fig. 2 (♂).

HT, ♂: Luzon Is., Isabela Prov., Sitio Apaya, Barangay Dibuluan, San Mariano, 200 m asl, vi.2005, A.C. Diesmos [UPLB, No. PHA-00356];

PT, ♂: Luzon Is., Isabela Prov., Sitio Apaya, Barangay Dibuluan, San Mariano, 200 m asl, vi.2005, A.C. Diesmos [UPLB, No. 00357].

- Brock & Büscher, 2022: 521.

- Hennemann, 2023b: 128.

Differentiation. – Males of this small species (the only sex known) are morphologically closest to *T. polillo* (Rehn & Rehn, 1939) and *T. kalahani* Lit & Eusebio, 2005. From the first they can be separated by the gradually widening meso- and metathorax, very small and tubercular anterior pronotals (large and tri-spinose in *polillo*) but large antero-laterals, lower carinae of the triangular mesonotal area, which is notably larger and covers almost two-thirds of the length of the mesonotum, much smaller supra coxal spines (wanting on mesopleurae), and lack of paired posterior spines on abdominal terga II-IV. From *kalahani* they can be differentiated by the stockier shape and limbs and gradually widening meso- and metathorax (mesothorax almost uniform in diameter in *kalahani*), having the anterior pronotals only represented as tubercles but the antero-laterals strongly spinose, as well as the larger triangular area of the mesonotum.

Remarks. – Female unknown. Body length ♂ 33.7 mm.

Distribution. – NE-Luzon. Province Isabela (Barangay Dibuluan, San Mariano 200 m [UPLB – type locality]).

Tisamenus tagalog (Rehn & Rehn, 1939)

(Fig. 43)

Hoploclonia tagalog Rehn & Rehn, 1939: 480, pl. 32: 17 (♂).

HT, ♂: Aroroy, Masbate Island, P.I.; (W. Boettcher) Aug. 8,1912; *Hoploclonia tagalog* Rehn & Rehn, Type #.1347; Data Base Serial No. Assigned as Type No. September 2008. Type #9129 [ANSP].

- Otte, 1978: 79. (Type data)

Tisamenus tagalog, Zompro, 2004: 207.

- Otte & Brock, 2005: 335.

- Brock & Büscher, 2022: 522.

- Hennemann, 2023b: 128.

Differentiation. – This species is only known from the unique ♂ holotype in the collection of ANSP (Fig. 43) and morphologically very close to *T. armadillo* Redtenbacher, 1906. Effectively, the only differences seen versus the ♂ of *armadillo* are the somewhat larger bifid anterior pronotal spines and supra-coxals of the meso- and metapleurae, more spinose supra-orbital, slightly convex and minutely tubercular carinae of the triangular mesonotal area that have the anterior angle just weakly protruded (rather concave with the anterior angle triangularly raised in *armadillo*), smaller epiproct that scarcely extends beyond the posterolateral angles of the anal segment, flattened and scoop-shaped poculum (deeply angular and bulgy in *armadillo*) and more prominent spines of the posterodorsal carina of the metafemora.

Remarks. – More specimens, including the still unknown ♀ and egg are required for a better distinction from closely related species but *T. armadillo* in particular. Body length ♂ 37.8 mm.

Distribution. – Masbate. Province Masbate (Aroroy [ANSP – type locality]).

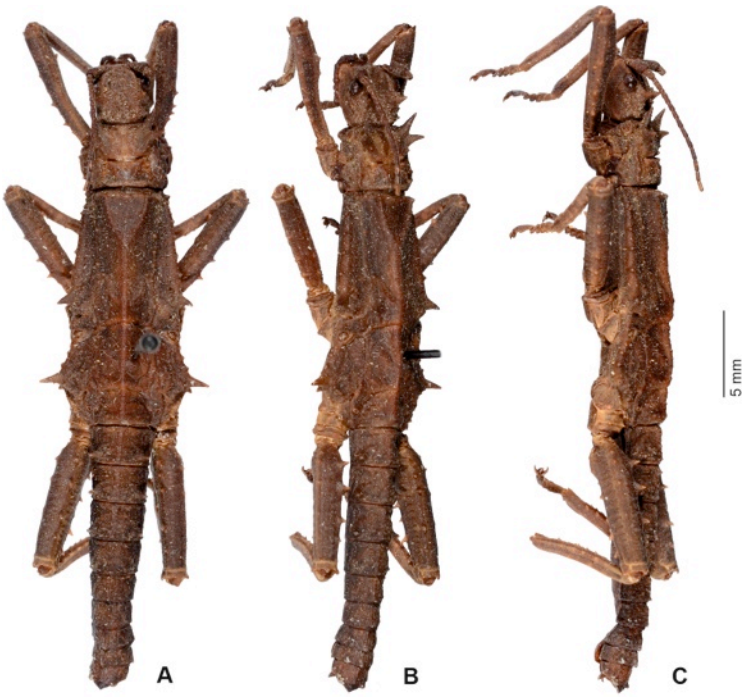

Fig. **43**. *Tisamenus tagalog* (Rehn & Rehn, 1939) ♂ HT [ANSP]. **A**. Dorsal view. **B**. Dorsolateral view. **C**. Lateral view.

***Tisamenus trapezoides* n. sp.**

(Fig. 44-45)

ZooBank: https://zoobank.org/2B9AFCA0-BEB1-42CB-A05B-2E483B30E221

HT, ♀: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, ii.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS].

PT, **1** ♀, **1** ♂: Coll. R.I.Sc.N.B., Philippines, E Luzon, Quirino, Sierra Madre, ii.2014, Purchased from I. Lumawig, Gift from B. Kneubühler, I.G.: 32.613 [RBINS].

Differentiation. – Females of this remarkable new species (Fig. 44A-C) are morphologically very close to those of *T. ranarius* (Westwood, 1859) but easily separable by the more distinctly widening meso- and metathorax, more tubercular lateral margins of the meso- and metapleurae as well as the larger and sub-spinose metapleural (obtuse and tuberculate in *ranarius*), notably larger, conical sub-orbitals, more distinct triangular area of the pronotum (Fig. 44G), much more pronounced medio-longitudinal keel of the dorsal body surface, comparatively weaker indicated longitudinal carinae of the mesosternum (Fig. 44H), considerably more developed armature of the limbs (metafemora in particular) and contrastive ochre to clay coloured tibiae. The dentiform apical protrusion on the exterior lateral carina od the scapus (Fig. 44G-H), remarkably reduced and almost indiscernible triangular mesonotal area (Fig. 44G) and sub-spiniform postero-laterals of the abdominal terga are shared with *ranarius* and all three features are likely to represent autapomorphies of these two species, which presumable represent sister taxa. The ♂ of *ranarius* are not known, but if compared to other congenerics these ♂ are morphologically closest to *T. deplanatus* (Westwood, 1848) and *T. cervicornis* Bolívar, 1890 but in addition to the characteristics shared with *ranarius* and mentioned above, may be distinguished from both species by the smaller size, more conical and stronger supra-orbitals, lack of an enlarged mesopleural, lack of paired posteriors on the abdominal terga and much smaller pronotal anterior, which is merely represented as a moderately sized simple spine (Fig. 45H; much larger and bi- or trifid in *deplanatus* and *cervicornis*).

Etymology. – The name of this very distinctive new species refers to the characteristic shape of the meso- and metathorax, which are strongly and uniformly widening towards the posterior and together form a trapeziform unit. Adjective.

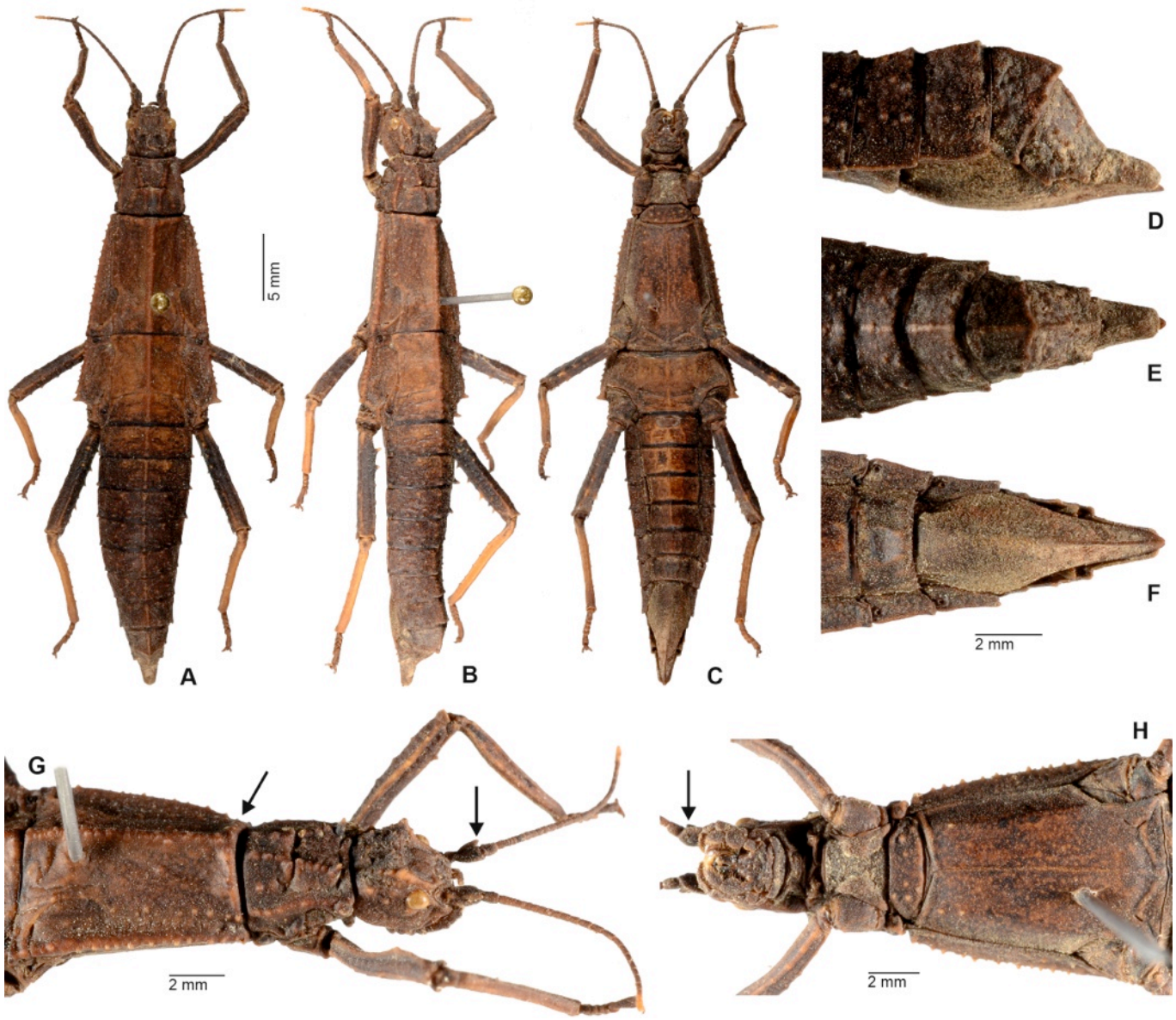

Fig. 44. *Tisamenus trapezoides* **n. sp.** ♀ HT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Ventral view. **D**. Terminalia in lateral view. **E**. Terminalia in dorsal view. **F**. Terminalia in ventral view. **G**. Closeup of head, pro- and mesonotum (arrows pointing the dentiform apical protrusion on the exterior lateral carina of the scapus and strongly reduced triangular mesonotal area). **H**. Closeup of head, pro- and mesosternum (arrow pointing to the dentiform apical protrusion on the exterior lateral carina of the scapus).

Description

♀ (Fig. 44)

Form and colouration. – Small for the genus (body length 44.2-44.8 mm); general form heavy with meso- and metathorax strongly and uniformly widening towards the posterior to form a distinct trapeziform unit (Fig. 44A); elements of armature weakly developed and body surface unevenly granular; legs short and moderately stocky. General colour buff to reddish fuscous dorsally, the ventral body surface with a slight buff to walnut brown hue; largest spines of head, thorax and limbs tipped with orange. Femora dark brown, tibiae contrastive ochre to clay coloured. Four terminal antennomeres straw coloured, the preceding gradually becoming brown towards scapus.

Head. – Roundly sub-quadrate, scarcely longer than wide with the genae roughly parallel-sided; coronal line and lateral furrow of vertex notably indented. Supra-orbitals prominent, triangular, laterally compressed and together with an anterior and posterior tubercle forming a crest-like element that is anteriorly extended into a shallow bulge that attains the bases of the antennae; occipitals and coronals rather low, rounded tuberculate; two gulars small and nodose (Fig. 44G). Eyes small, sub-globose and their diameter corresponding to a little less than half the length of gena. Antennae strong, reaching to tip of protarsi and consisting of 26 joints, the basal half of antennae except three basal joints perlamorph in appearance; scapus somewhat narrowing towards base with exterior lateral margin apically protruded into an obtuse dentiform protrusion; pedicellus less than half as long as scapus, barrel-shaped; III notably shorter, IV-VIII transverse and up to XIX gradually increasing in length; terminal antennomere somewhat elongated and slightly longer than preceding joint.

Thorax. – Pronotum sub-trapeziform; triangular area fairly distinct with margins shallowly tubercular and the anterolateral angles with a strong and slightly backward arched spine; the four tubercles directly in front and behind the transverse median sulcus somewhat enlarged, obtuse; antero-lateral low, tubercular (Fig. 44G). Mesothorax trapeziform, distinctly, gradually and uniformly widening towards posterior, almost 2.0x longer than prothorax and with posterior portion almost 1.7x wider than anterior margin. Mesonotum sub-rectangular in outline with a distinct concave post-medial constriction; about 1.7x longer than width at anterior margin; over entire length with a distinct, granular medio-longitudinal ridge, the triangular area very small and merely represented by three low granules at anterior margin of notum that are arranged in a triangle (Fig. 44G). Mesopleurae strongly expanded and widening towards the posterior, triangular in dorsal aspect, the laterals margins densely but somewhat unevenly tubercular; mesopleural missing. Metanotum slightly transverse with a distinct pre-median narrowing and the same medio-

longitudinal keel seen on mesonotum. Metapleurae basically like mesopleurae, strongly expanded but the supra-coxal angle with a prominent, strong but blunt and sub-spiniform metapleural; supra-coxal very small, low and nodose. Prosternal sensory-areas well developed; probasisternum with a transverse row of four low nodes, the exterior ones of which are more pronounced. Mesosternum weakly tri-carinate with the lateral carinae less pronounced and supplied with 2-3 low nodes anteriorly; metasternum only with a faint indication of a medio-longitudinal carina (Fig. 44H).

Abdomen. – Median segment distinctly transverse, roughly pentagonal and obtusely keeled medio-longitudinally. Segments II-VII all distinctly transverse, slightly decreasing in length and on average about 3x wider than long; IV-X slightly but almost gradually narrowing. Terga all with a distinct medio-longitudinal carina which is posteriorly terminating in swelling, that is sub-obsolete on II, nodose on II-V and dentiform, on VI-VIII and forms a tectate swelling on IX that covers almost the whole dorsal surface of tergum (Fig. 44D); first and second paired posteriors merely represented as small granules; postero-laterals distinct and sub-spinose on II-IV. Sterna II-VI rather smooth with a shallow medio-longitudinal keel; II with a distinct roundly rectangular, transverse indention antero-medially; VII with a pair of low, converging bulges that terminate in an obtuse swelling posteriorly. Anal segment weakly trapezoidal in outline and strongly declining; the lateral margins obliquely convergent in posterior half and protruded into an obtuse tooth at the angle; the posterior margin weakly rounded with outer angles somewhat protruded (Fig. 44E). Epiproct convex with a faint indication of a medio-longitudinal carina, gradually convergent and the apex flattened and obtusely rounded (Fig. 44E). Subgenital plate navicular, carinate apically and progressively narrowing towards a rather pointed apex, that scarcely surpasses the epiproct (Fig. 44F).

Legs. – Moderately stocky with only the ventral femoral teeth notably developed, only dorsal carina of metafemora with two upright basal spines on posterior carina, of which the basal spine is much larger than the rather tubercular second one. Pro- and mesofemora somewhat shorter than mesothorax, metafemora reaching halfway along abdominal segment V and metatibiae almost attaining anal segment. Two ventral carinae of mesofemora with four blunt teeth that increase in size towards apex of femur; dorsal carinae only with some low swellings. The five ventral teeth of metafemora prominent, obtusely spiniform and becoming stronger towards apex of femur. Pro- and mesotibiae wholly unarmed; metatibiae only with 5-6 faint indications of teeth on two ventral carinae. Basitarsi short and no longer than following two tarsomeres combined.

Measurements of holotype [mm]. – Body 44.2, pronotum 4.1, mesonotum 8.5, metanotum 4.3, median segment 2.3, profemora 7.8, mesofemora 6.5, metafemora 8.1, protibiae 6.8, mesotibiae 6.4, metatibiae 9.0, antennae 11.0.

Measurements of paratype [mm]. – Body 44.8, pronotum 4.1, mesonotum 8.6, metanotum 4.3, median segment 2.3, profemora 7.5, mesofemora 6.8, metafemora 8.7, protibiae 7.0, mesotibiae 6.2, metatibiae 9.1, antennae 11.5.

♂ (Fig. 45)

Form and colouration. – Size small (body length 32.8 mm); general form relatively slender, legs fairly strong with the metafemora incrassate; elements of armature weakly developed, essentially as in ♀ but cephalic and prothoracic elements as well as the metapleural supra-coxal comparatively more prominent; the second paired posteriors seen on terga II-IV of ♀ missing and the posteromedian protrusion of abdominal terga VII-IX less distinct. Meso- and metathorax less than in ♀, but notably gradually widening towards posterior and together forming a trapeziform unit; body surface unevenly granular. Colour basically as in ♀.

Head. – As in ♀ but with the supra-orbitals and coronals more pronounced. Antennae only with 24 joints (Fig. 45H).

Thorax. – Pronotum like in ♀ but the anteriors more spiniform (Fig. 45H). Mesothorax gradually widening towards posterior, about 1.8x longer than prothorax and with posterior portion almost 1.4x wider than anterior margin. Mesonotum elongate with lateral margins weakly convergent towards the posterior and with a distinct concave post-medial constriction; about 2.x longer than width at anterior margin; over entire length with a granular medio-longitudinal ridge that is weakly gibbose posteriorly; the triangular area very small and merely represented by three low granules at anterior margin of notum that are arranged in a triangle (Fig. 45H). Mesopleurae strongly expanding towards the posterior, triangular in dorsal aspect, the laterals margins merely sub-tubercular and without any enlarged tubercles; mesopleural missing. Metanotum roughly rectangular with a distinct median narrowing and the same medio-longitudinal keel seen on mesonotum; posterior portion weakly gibbose. Metapleurae basically like mesopleurae but the supra-coxal angle with a prominent, strong but blunt supra-coxal tubercle; metapleural low and nodose. Mesosternum weakly tri-carinate with the lateral carinae less pronounced and somewhat irregular (Fig. 45I); metasternum only with a faintly indicated medio-longitudinal carina in anterior portion.

Abdomen. – Median segment distinctly transverse and roundly pentagonal, surface weakly carinate medio-longitudinally. Segments II-VII slightly sub-uniform in length and width, II-III very gently narrowing and V-VII indistinctly decreasing in length; II sub-trapeziform and IV about 1.6x wider than long. All terga with a shallow but bold medio-longitudinal bulge that is most prominent on three terminal terga and comparatively more acute and raised on anal segment; on IX posteriorly terminating in a low, obtuse swelling (Fig. 45D). Second paired posterior merely represented as very low, sub-obsolete nodes on II and III. Sterna II-VI weakly tri-carinate, VII and VIII bi-carinate. Anal segment moderately declining, trapezoidal in outline and narrowed posteriorly with the lateral margins obliquely angular; posterior margin with a wide and very shallow, angular median emargination and the outer angles obtusely rounded (Fig. 45E). Epiproct slightly transverse, rounded, scale-like and notably projecting beyond posterolateral protrusions of anal segment (Fig. 45E). Poculum roundly cup-shaped with a very broad and rounded, labiate posterior flange of the free upper margin, that is minutely and narrowly indented medially and reaches about halfway along anal segment (Fig. 45F).

Legs. – Moderately stocky with only the ventral femoral teeth notably developed; armature essentially as in ♀ but femora much more incrassate. Pro- and mesofemora noticeably shorter than mesothorax, metafemora reaching halfway along abdominal segment IV and metatibiae almost attaining anal segment. The four ventral teeth of metafemora prominent, obtusely spiniform and becoming stronger towards apex of femur; ventro-basal swelling of metafemora rather shallow and smooth (Fig. 45G). Pro- and mesotibiae wholly unarmed; metatibiae only with 3-6 faint indications of teeth on two ventral carinae (Fig. 45G). Basitarsi short and no longer than following two tarsomeres taken together.

Measurements of paratype [mm]. – Body 32.8, pronotum 3.5, mesonotum 6.8, metanotum 3.4, median segment 1.8, profemora 5.2, mesofemora 4.9, metafemora 5.9, protibiae 5.1, mesotibiae 4.8, metatibiae 5.8, antennae 8.9.

Variability. – No noteworthy morphological variability is seen in the three type-specimens.

Distribution. – Luzon: Province Quirino, Sierra Madre [RBINS].

Rearing

Like most members of the tribe Obrimini, representatives of the genus *Tisamenus* are easily reared in captivity and feed on a variety of alternative food plants. During the past fifteen years, seven species have been successfully reared in captivity in Europe and as at 2024 cultures of five species are still being maintained in culture. These include *T. cervicornis*, *T. deplanatus*, *T. draconinus*, *T. lachesis* and *T. napalaki*. The cultures of *T. clotho* and *T. hystrix* died out after only a few generations. One species, *T. lachesis*, has been introduced to Europe on several occasions and from different localities, but it seems that only one stock has remained widespread among European cultures. This species and *T. draconinus* are among the most commonly reared Obrimini species and easily reproduce in large numbers. More detailed information on the culture stocks and their origins are presented above in the 'remarks' sections of the concerned species. The stocky shape, often spectacular spination and appealing colour varieties of some species are surely some of the main reasons why *Tisamenus*-species have become fairly popular among phasmid enthusiasts. Several papers have since dealt with the captive breeding, biology, life-cycle, habits and origins of culture stocks of *Tisamenus*-species (e. g. Krijns, 2011; Dräger, 2012). The general

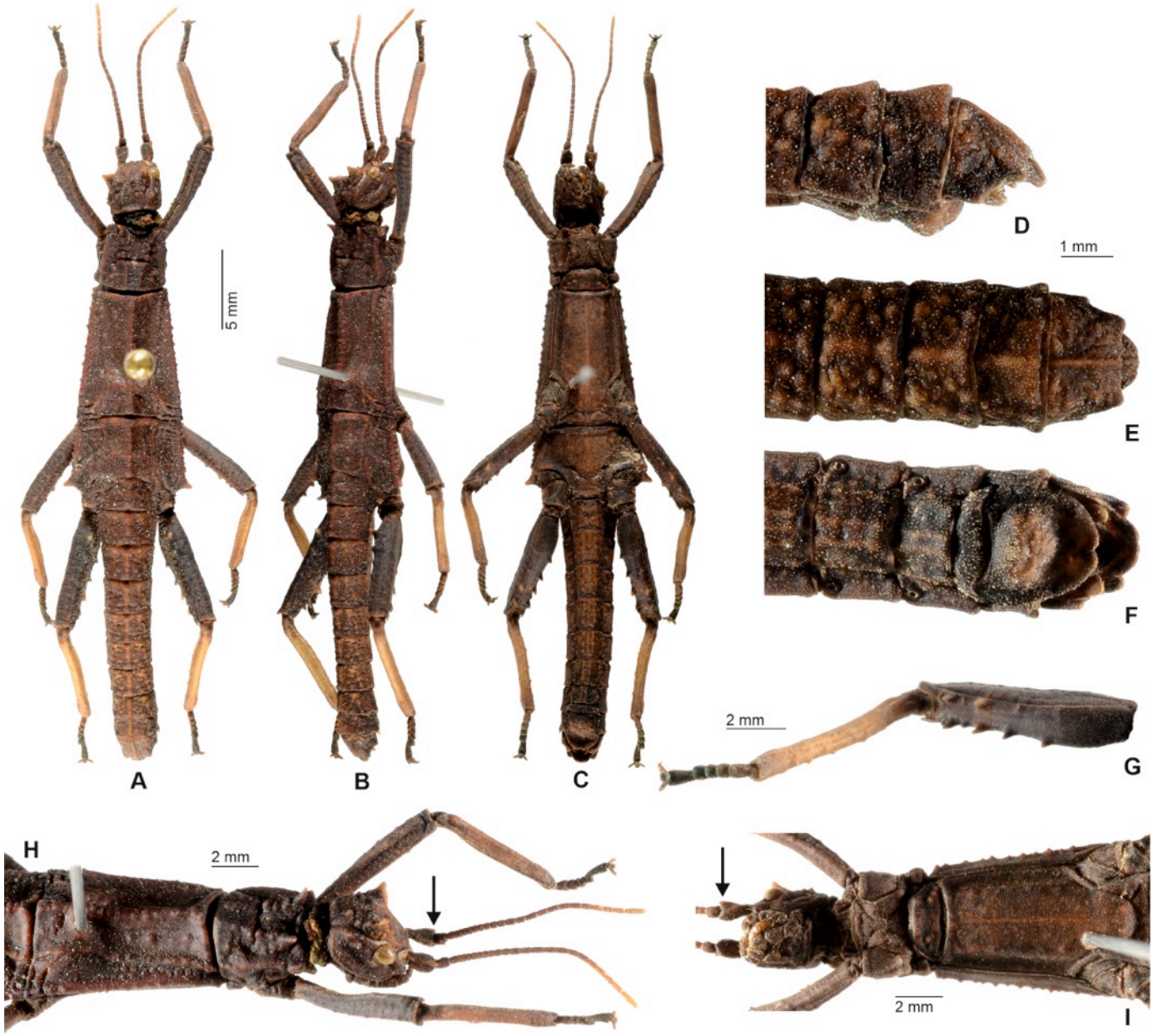

Fig. **45**. *Tisamenus trapezoides* **n**. **sp**. ♂ PT [RBINS].

A. Dorsal view. **B**. Dorsolateral view. **C**. Ventral view. **D**. Terminalia in lateral view. **E**. Terminalia in dorsal view. **F**. Terminalia in ventral view. **G**. Anteroventral view of left hind leg. **H**. Closeup of head, pro- and mesonotum (arrows pointing to the dentiform apical protrusion on the exterior lateral carina of the scapus and strongly reduced triangular mesonotal area). **I**. Closeup of head, pro- and mesosternum (arrow pointing to the dentiform apical protrusion on the exterior lateral carina of the scapus).

standard conditions for breeding *Tisamenus*-species successfully in captivity widely corresponds to those for other members of Obrimini (Hennemann, 2023b), since most species originate from similar natural habitats and share similar climatic preferences and habits, such as the egg laying technique, with ♀ using their beak-like ovipositor to bury eggs in a suitable substrate. According to the rather small size of the individual species small plastic or glass terrariums are adequate and since most species prefer high humidity, little ventilation is needed and the insects should regularly be sprayed with water. The terrarium should have a several centimetre thick bottom layer of substrate or contain a plastic container filled with vermiculite, peat or sand for oviposition. Some species also prefer moss for oviposition, which can be placed on the floor or in corners of the terrarium. Most species prefer to rest on the ground or hide in hollows during the day, why a layer of foliage or pieces of cork bark or mossy stems should be provided. Eggs can either be left in the bottom layer of substrate of the breeding terrarium or can be transferred to separate containers for incubation but need to be buried and kept humid. Hatching rates are usually quite high and the hatchlings are sturdy with only few losses throughout the nymphal development. All five aforementioned species are rather polyphagous at least in captivity and feed on a variety of different alternative plants. Alternative food plants commonly accepted in captivity in Europe include numerous Rosaceae such as bramble (*Rubus spp.*), raspberry (*Rubus idaeus*), roses (*Rosa* spp.), pyracantha (*Pyracantha coccinea*) or hawthorn (*Crataegus monogyna*) but also plants from various other families including hazel (*Corylus avellana*, Betulaceae), oaks (*Quercus* spp., Fagaceae), beech (*Fagus sylvatica*, Fagaceae), St. John's Wort (*Hypericum patulum* and *H. androsaemum,* Hypericaceae) or ivy (*Hedera helix*, Araliaceae). On average most species have one generation per year at temperatures of 20-25°C, but *T. draconinus* has proven very fast-developing with almost two generations per year.

Fig. **46**. Eggs of *Tisamenus* spp., dorsal view (left) and lateral view (right).

A-**B**. *T. armadillo* Redtenbacher, 1906 (ex ovipositor LT) [SMTD © Christian Schmidt]. **C**-**D**. *T. cervicornis* Bolívar, 1890 [FH]. **E**-**F**. *T. charestae* Hennemann & Le Tirant **n**. **sp**. (paratype) [FH]. **G**-**H**. *T. clotho* (Rehn & Rehn, 1939) [FH]. **I**-**J**. *T. deplanatus* (Westwood, 1848) [FH]. **K**-**L**. *T. draconinus* (Westwood, 1848) [FH. **M**-**N**. *T. hebardi* (Rehn & Rehn, 1939) [RBINS]. **O**-**P**. *T. Lachesis* (Rehn & Rehn, 1939) [FH]. **Q**-**R**. *T. napalaki* **n**. **sp**. (paratype) [FH]. **S**-**T**. *T. polillo* (Rehn & Rehn, 1939) [FH]. **U**-**V**. *T. serratorius* Stål, 1875 [FH]. **W**-**X**. *T. spadix* (Rehn & Rehn, 1939) [FH].

Summary & discussion

The present paper has provided a taxonomic review of the Philippine Obrimini genus *Tisamenus* Stål, 1875 (subfamily Heteropteryginae) and all known species have been discussed. The genus was omitted in the recent review of the Philippine Obrimini by Hennemann (2023b) due to its complexity and species richness, as the most speciose genus among the Obrimini. In addition to the description of seven new species, several previously unknown sexes and eggs could be described herein and numerous new records of various species were presented to broaden our knowledge on the geographic distributions of the genus and its 24 valid species. Examination of all type material has also uncovered two new synonymies. The seven new species described herein represent approximately 30% of the current known diversity of *Tisamenus* and have almost doubled the number of previously known species, thereby constituting a noteworthy enhancement of our knowledge of the diversity of this remarkable genus and demonstrating our still fractional knowledge of the true diversity of Philippine Obrimini. Further new species are very likely to be discovered if more sampling throughout the complex geography of the Philippine archipelago is conducted, especially in less prospected islands and specific areas that are known to inherit high degrees of endemism. Based on external morphology of the insects the genus *Tisamenus* can be sub-divided into three groups of similar species. The *Serratorius* Group comprises the more slender and spinose forms in which the mesothorax is at best slightly widening towards the posterior (*T. charestae* **n**. **sp**., *T. clotho*, *T. draconinus*, *T. hebardi*, *T. heitzmanni* **n**. **sp**., *T. hystrix*, *T. irenoliti* **n**. **sp**., *T. lachesis*, *T. napalaki* **n**. **sp**., *T. polillo* and *T. serratorius*). Also, *T. kalahani*, *T. makinis* **n**. **sp**. and *T. summaleonilae* need to be assigned to this first group, although all three species are characteristic for their remarkably reduced body armature and are the smoothest representatives of the genus. The *Deplanatus* Group comprises the stockier and less spinose forms that have a distinctly trapezoidal mesothorax and mostly lack mesopleural spines except for a single supra-coxal (*T. alviolanus*, *T. armadillo*, *T. asper*, *T. cervicornis*, *T. deplanatus*, *T. malawak* **n**. **sp**., *T. spadix* and *T. tagalog*). Finally, the *Ranarius* Group comprises *T. ranarius* and *T. trapezoides* **n**. **sp**., which share a strongly reduced mesonotal triangular area and an apical tooth or spine on the outer lateral carina of the scapus. Both characters clearly distinguish the *Ranarius* Group from the remainder of *Tisamenus* and appear to violate the generic diagnosis, and, if splitting of the genus will become necessary e. g. due to molecular evidence it is believed that the two species may need to be separated from *Tisamenus* and placed in a genus on their own.

In general, it is known that still a plethora of new species of Phasmatodea from throughout the Philippines await formal description, many of which are endemics to individual islands or certain isolated habitats on islands. The impressive biodiversity of Philippine Phasmatodea however, is badly threatened by an increasing destruction and loss of forest, made obvious by some very alarming figures. From 2002 to 2021, the Philippines lost 158kha of humid primary forest, making up 12% of its total tree cover loss and the total area of humid primary forest in the Philippines decreased by 3.4% in this time period of less than twenty years. About 92% of this loss occurred in areas where the main reason is deforestation by human (Source: https://globalforestwatch.org, accessed 20.05.2023). Small and isolated island faunas are particularly vulnerable, such massive degrees of deforestation can have severe impact on the biodiversity. It is known that protected forests experience the lowest deforestation and thus it must be hoped that there will rapidly be efforts to protect the remaining forest areas of the Philippines to help retain as much as possible of the highly threatened endemic biodiversity of the archipelago. Therefore, it is hoped that the description of new species of stick-insects will support considerations that ensure the survival and protection of endangered areas within the Philippines.

The Obrimini clade is principally of Philippine origin where it has predominantly radiated with only very few representatives known from outside the Philippines, that is to say Borneo, Wallacea and Fiji (Hennemann *et al.*, 2016: 109; Bank *et al.*, 2021; Hennemann, 2023). Eleven of the 14 known genera of Obrimini are found in the Philippines and nine of these are endemic to the archipelago, which includes *Tisamenus*. Biogeographically, *Tisamenus* can be regarded as predominantly Luzonian because the majority of known species is restricted to the Greater Luzon Region, which includes the Polillo Islands and Masbate (Chaffee, 1969; Heaney & Regalado 1998; Sinha & Heaney 2006). However, there is also one species on the island of Sibuyan, which is referred to as a separate biogeographic region (Chaffee, 1969; Heaney & Regalado 1998; Sinha & Heaney 2006) two species in the Greater Negros-Panay Region as well as one species on the Island of Leyte and one species on Camiguin Island, both of which are biogeographically assigned to the Greater Mindanao Region. A satisfactory reconstruction of the radiation and track lines of *Tisamenus* within the Philippines, however, is mainly hindered by the complex geography and geology of this large archipelago and a lack of data. The diversification of most lineages of Obrimini and dispersal among the archipelago is believed to have most likely occurred not earlier than during the low seal-levels in the Pliocene and Pleistocene (Bank *et al.*, 2021: 16). Still however, any more comprehensive discussion on the dispersal of Obrimini throughout the complex Philippine archipelago warrants much more data and confirmed information on the tectonic history and geology of the Philippines.

Although many species of *Tisamenus* are being reared in captivity and have become popular with phasmid enthusiasts throughout Europe, very little is known about the natural habits and host plants of these insects. Members of this peculiar genus have settled a wide range of different habitats throughout the Philippines, with the exception of Greater Mindanao, that range from coastal or coastal near dry forests, humid lowland forests and montane forests up to altitudes of almost 2000 metres. Species of *Tisamenus* are largely ground dwelling and live within ground near or low vegetation in their habitats. Like all other Obrimini, *Tisamenus* has the same derived egg-laying strategy, with ♀ descending from their host plants during the night and using their beak-like ovipositor to bury the eggs in a suitable substrate.

Checklist of Philippine Obrimini

The following is an updated alphabetical checklist of all known Philippine genera and species of Obrimini, including the taxonomic changes conducted in the present work. Up to date 71 valid species are known, which belong to eleven genera, the most speciose of which is *Tisamenus* Stål, 1875 that was treated herein.

Aretaon Rehn & Rehn, 1939

Aretaon asperrimus (Redtenbacher, 1906)

Armadolides Hennemann, 2023

Armadolides manobo (Acola, Naredo & Eusebio, 2022)

Brasidas Rehn & Rehn, 1939
= *Euobrimus* Rehn & Rehn, 1939

Brasidas bakeri (Rehn & Rehn, 1939)
= *Euobrimus hoplites* Rehn & Rehn, 1939

Brasidas cavernosus (Stål, 1877)

Brasidas foveolatus (Redtenbacher, 1906)

Brasidas lacerta (Redtenbacher, 1906).
= *Brasidas acanthoderus* Rehn & Rehn, 1939
= *Euobrimus atherura* Rehn & Rehn, 1939
= *Euobrimus cleggi* Rehn & Rehn, 1939
= *Euobrimus dohrni* Rehn & Rehn, 1939
= *Brasidas foveolatus asper* Rehn & Rehn, 1939
= *Brasidas montivagus* Rehn & Rehn, 1939
= *Euobrimus stephenreyesi* Lit & Eusebio, 2006

Brasidas malaki Hennemann, 2023
Brasidas manobo Hennemann, 2023
Brasidas rehni Hennemann, 2023
Brasidas samarensis Rehn & Rehn, 1939
Brasidas viscayanus Rehn & Rehn, 1939
Brasidas waray Hennemann, 2023

Eubulides Stål, 1877
Eubulides alutaceus Stål, 1877
Eubulides blaan Hennemann, 2023
Eubulides constanti Hennemann, 2023
Eubulides igorrote Rehn & Rehn, 1939
Eubulides lumawigi Hennemann, 2023
Eubulides taylori Rehn & Rehn, 1939
Eubulides timog Hennemann, 2023

Mearnsiana Rehn & Rehn, 1939
= *Hennobrimus* Conle, 2006
Mearnsiana bullosa Rehn & Rehn, 1939
= *Hennobrimus hennemanni* Conle, 2006
= *Trachyaretaon manobo* Lit & Eusebio, 2005
Mearnsiana maranao Hennemann, 2023

Obrimus Stål, 1875
Obrimus bicolanus Rehn & Rehn, 1939
Obrimus bufo (Westwood, 1848)
Obrimus mesoplatus (Westwood, 1848).
Obrimus quadratipes Bolívar, 1890.
Obrimus uichancoi Rehn & Rehn, 1939

Stenobrimus Redtenbacher, 1906
Stenobrimus bolivari Redtenbacher, 1906
Stenobrimus lumad Lit & Eusebio, 2010
Stenobrimus pilipinus Eusebio, Lit & Lucañas, 2023
Obrimus tagalog Rehn & Rehn, 1939

Sungaya Zompro, 1996
Sungaya aeta Hennemann, 2023
Sungaya dumagat Hennemann, 2023
Sungaya ibaloi Hennemann, 2023
Sungaya inexpectata Zompro, 1996

Theramenes Stål, 1875
Theramenes dromedarius Stål, 1877
Theramenes exiguus Hennemann & Conle, 2003
Theramenes letiranti Hennemann, 2023
Theramenes mandirigma Zompro & Eusebio, 2001

Tisamenus Stål, 1875
= *Ilocano* Rehn & Rehn, 1939
Tisamenus alviolanus Lit & Eusebio, 2010
Tisamenus armadillo Redtenbacher, 1906
Tisamenus asper Bolívar, 1890
Tisamenes cervicornis Bolívar, 1890
= *Tisamenus fratercula* (Rehn & Rehn, 1939) **n**. **syn**.
Tisamenus charestae Hennemann & Le Tirant **n**. **sp**.
Tisamenus clotho (Rehn & Rehn, 1939)
= *Tisamenus atropos* (Rehn & Rehn, 1939) **n**. **syn**.
Tisamenus deplanatus (Westwood, 1848)
Tisamenus draconinus (Westwood, 1848)
Tisamenus hebardi (Rehn & Rehn, 1939)
Tisamenus heitzmanni **n**. **sp**.
Tisamenus hystrix (Rehn & Rehn, 1939)
Tisamenus irenoliti **n**. **sp**.
Tisamenus kalahani Lit & Eusebio, 2005
Tisamenus lachesis (Rehn & Rehn, 1939)
Tisamenus makinis **n**. **sp**.
Tisamenus malawak **n**. **sp**.
Tisamenus napalaki **n**. **sp**.
Tisamenus polillo (Rehn & Rehn, 1939)
Tisamenus ranarius (Westwood, 1859)
Tisamenus serratorius Stål, 1875
Tisamenus spadix (Rehn & Rehn, 1939)
Tisamenus summaleonilae Lit & Eusebio, 2005
Tisamenus tagalog (Rehn & Rehn, 1939)
Tisamenus trapezoides **n**. **sp**.

Trachyaretaon Rehn & Rehn, 1939
Trachyaretaon bresseeli Hennemann, 2023
Trachyaretaon carmelae Lit & Eusebio, 2005
= *Trachyaretaon bruecknerí* Hennemann & Conle, 2006
Trachyaretaon echinatus (Stål, 1877)
Trachyaretaon gatla Zompro, 2004
Trachyaretaon maliit Hennemann, 2023
Trachyaretaon mangyan Hennemann, 2023
Trachyaretaon nakatago Hennemann, 2023
Trachyaretaon negrosanon Hennemann, 2023
Trachyaretaon tumandok Hennemann, 2023

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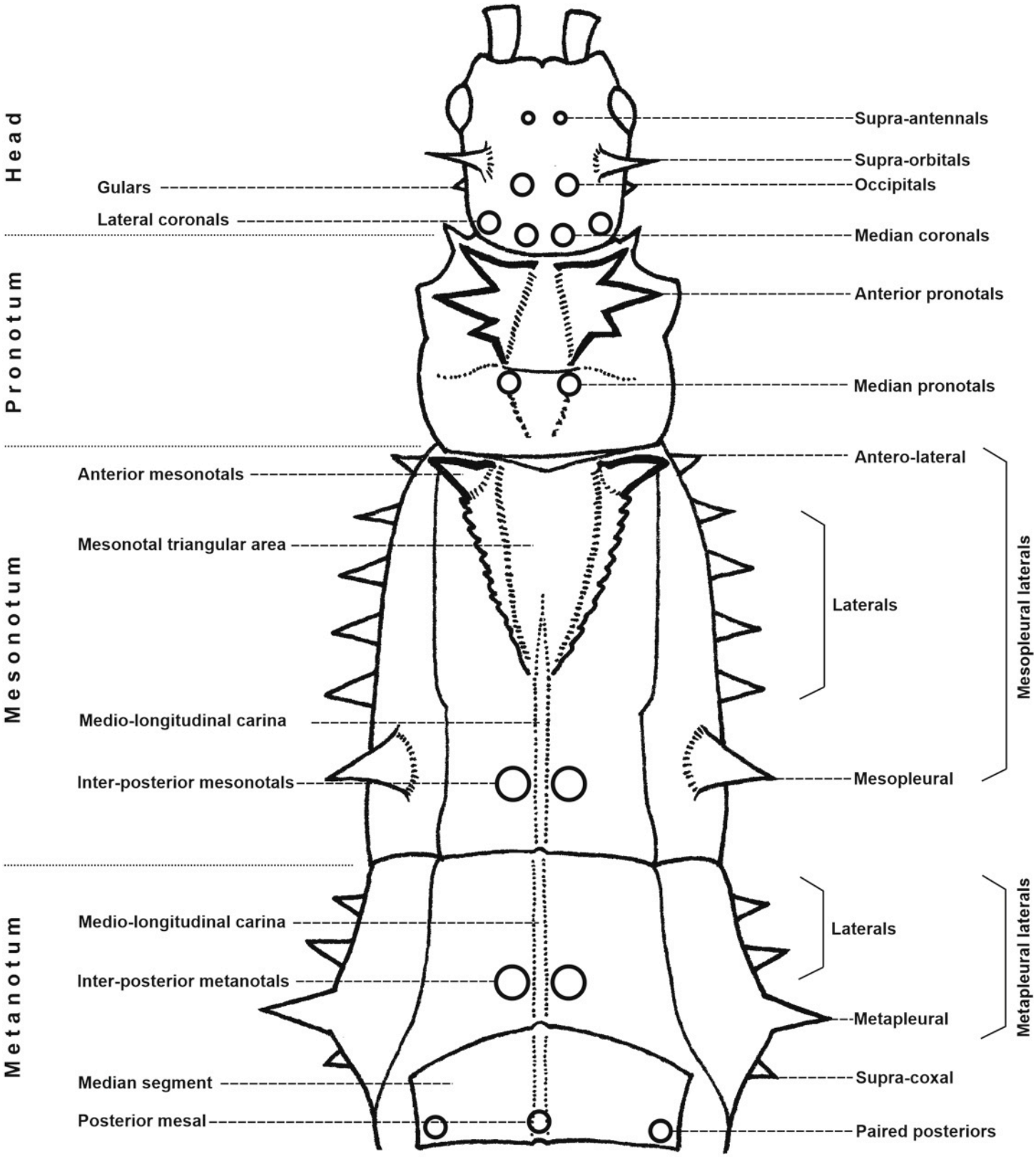

Fig. **47**. Cephalic and thoracic acanthotaxy of *Tisamenus* Stål, 1875

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Résumé

Hennemann F. H., 2025. – Révision des Obrimini philippins : le genre *Tisamenus* Stål, 1875 (Insecta : Phasmatodea : Heteropterygidae : Obriminae). *Faunitaxys*, 13(24) : 1 – 85.

La révision du genre philippin *Tisamenus* Stål, 1875 (Obriminae : Obrimini) au niveau de l'espèce est présentée. Des diagnoses différentielles ainsi que des notes sur la variabilité intraspécifique et la répartition géographique, y compris un grand nombre de nouvelles observations, sont fournies pour les vingt-quatre espèces connues, vingt-deux d'entre elles étant illustrées. Des clés d'identification des espèces sont présentées pour distinguer les femelles des mâles. Sept nouvelles espèces sont décrites : *T. charestae* Hennemann & Le Tirant **n**. **sp**. de Luçon et *T. napalaki* **n**. **sp**. de Luçon et Palaui sont décrites à partir de la femelle, du mâle et de l'œuf, *T. trapezoides* **n**. **sp**. de Luçon à partir de la femelle et du mâle, et *T. heitzmanni* **n**. **sp**. de Cebu, *T. irenoliti* **n**. **sp**. de Marinduque, *T. makinis* **n**. **sp**. de Luzon et *T. malawak* **n**. **sp**. de Camiguin sont décrits à partir des mâles uniquement. Deux nouvelles synonymies sont proposées : *T. fratercula* (Rehn & Rehn, 1939) est synonymisé avec *T. cervicornis* Bolívar, 1890 et *T. atropos* (Rehn & Rehn, 1939) est synonymisé avec *T. clotho* (Rehn & Rehn, 1939). L'espèce type de *T. serratorius* Stål, 1875 est pour la première fois signalée dans une localité précise de l'île de Luzon et est redécrite et illustrée avec les descriptions du mâle et de l'œuf jusqu'alors inconnus. Les mâles jusqu'alors inconnus de *T. armadillo* Redtenbacher, 1906, *T. clotho* (Rehn & Rehn, 1939, *T. deplanatus* (Westwood, 1848), *T. draconinus* (Westwood, 1848) et *T. hebardi* (Rehn & Rehn, 1939) sont décrits et/ou illustrés pour la première fois, tout comme les femelles jusqu'alors inconnues de *T. hystrix* (Rehn & Rehn, 1939), *T. lachesis* (Rehn & Rehn, 1939), *T. polillo* (Rehn & Rehn, 1939) et *T. spadix* (Rehn & Rehn, 1939). Également, les œufs de *T. tatou* Redtenbacher, 1906, *T. cervicornis* Bolívar, 1890, *T. clotho* (Rehn & Rehn, 1939), *T. deplanatus* (Westwood, 1848), *T. draconinus* (Westwood, 1848), *T. hebardi* (Rehn & Rehn, 1939), *T. lachesis* (Rehn & Rehn, 1939), *T. polillo* (Rehn & Rehn, 1939), *T. serratorius* Stål, 1875 et *T. spadix* (Rehn & Rehn, 1939) sont décrits et illustrés pour la première fois. Une seule espèce, *T. armadillo* Redtenbacher, 1906, demeure sans localisation précise, la localité type historique étant uniquement « Philippines ». Les holotypes des espèces nouvellement décrites sont déposés dans les collections de l'Institut royal des sciences naturelles de Belgique, Bruxelles (RBINS), du Musée zoologique de l'Université de Kiel (Allemagne) (ZMK) et de l'Insectarium de Montréal, Québec (Canada) (IMQC).

Mots-clés. – Phasmida, Areolatae, Obrimini, *Tisamenus*, nouvelles espèces, nouveaux synonymes, clés, descriptions, lectotypes, distribution.

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SOMMAIRE

Révision des Obrimini philippins : le genre *Tisamenus* Stål, 1875 (Insecta: Phasmatodea: Heteropterygidae: Obriminae).

Frank H. Hennemann . . . . . 1 – 85

CONTENTS

A taxonomic review of Philippine Obrimini stick insects: The genus *Tisamenus* Stål, 1875 (Insecta: Phasmatodea: Heteropterygidae: Obriminae).

Frank H. Hennemann . . . . . 1 – 85

Illustration de la couverture : oeufs.

Haut gauche : *Tisamenus clotho* (Rehn & Rehn, 1939).
Haut droit : *Tisamenus armadillo* Redtenbacher, 1906.
Bas gauche : *Tisamenus polillo* (Rehn & Rehn, 1939).
Bas droit : *Tisamenus cervicornis* Bolívar, 1890.

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